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A. S. Burleson, Postmaster General.

The Welding Engineer

Vol. III. Chicago 608 S. Dearborn St. JULY, 1918 $2.00 per year in U. S. $2.50 per year abroad No. 7

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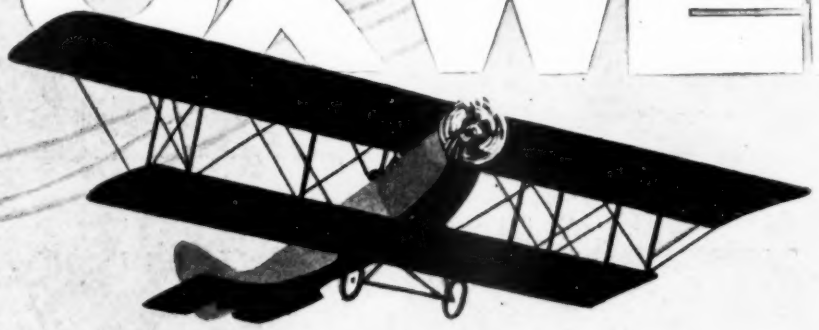

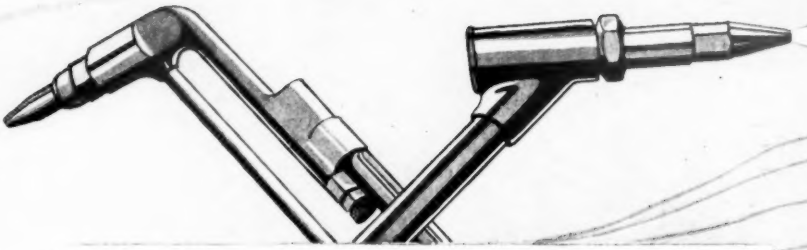

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THAT the safest way is to purchase these supplies from concerns known to be thoroughly familiar with the requirements?

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Burdett Oxygen Co.
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United States Welding Co.
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American Welding Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
The Evleth-Lindsay Co.
The Harris Calorific Co.
Messer Mfg. Co.
Henderson-Willis Welding & Cutting Co.
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Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
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United States Welding Co.
Universal Oxygen Co.

TORCHES (Oxy-Hydrogen Cutting)
Air Reduction Sales Co.
American Welding Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
The Evleth-Lindsay Co.
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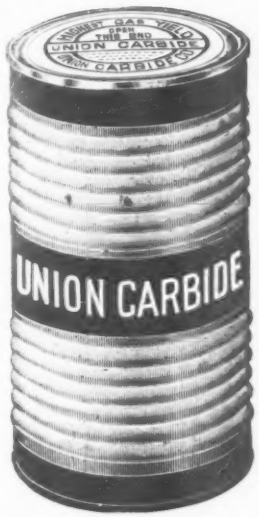

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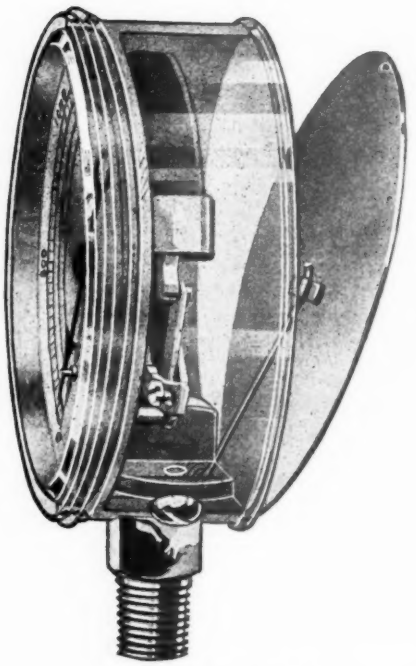

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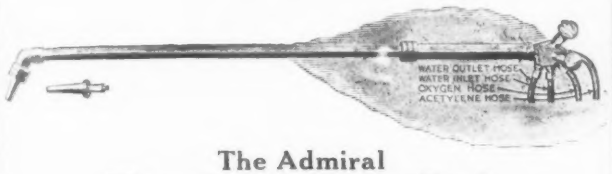

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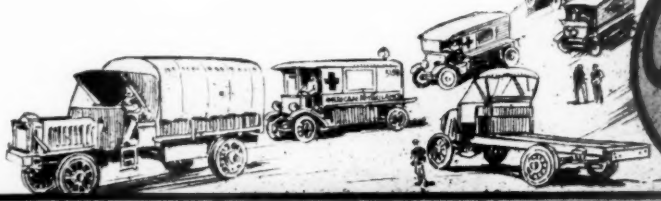

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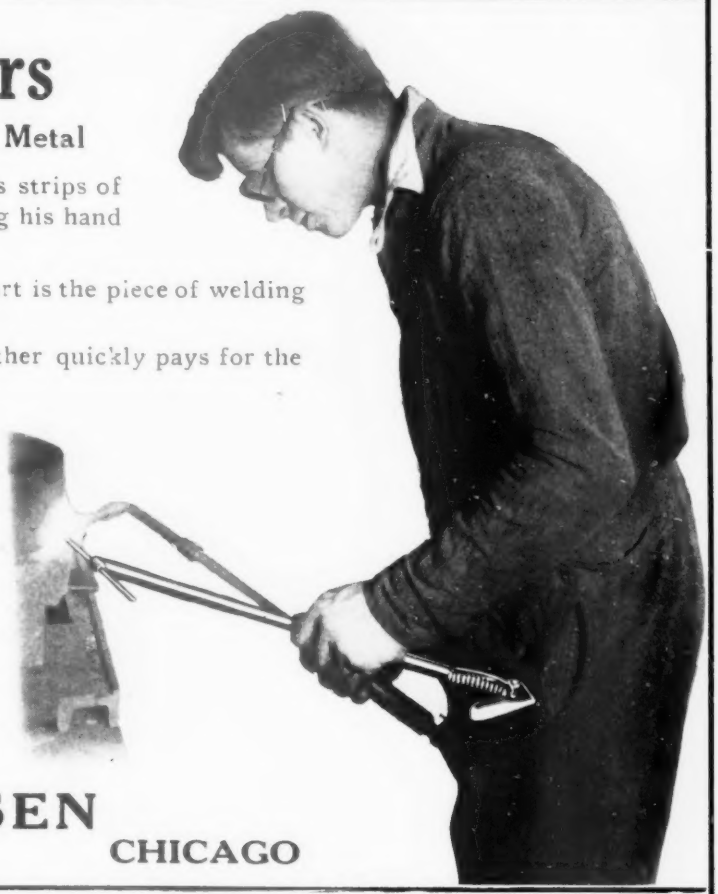

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¶ *Collier's* for March 2nd published a double-page illustration with the title, "An Impossible Plan that Worked."

¶ It showed how oxy-acetylene apparatus was used to cut the Lake steamships apart so they could be brought through the canal locks, and weld them together again when they reached the seaboard.

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P7

The ARMY LECTURE COURSE

Suggested Answers to a Series of Questions Used by the Army Welding School at Peoria, Ill. A discussion of these questions and answers would benefit the industry and readers are invited to send their views to the Editor

Suggested Answers by Mr. S. W. Miller, Rochester Welding Works

LECTURE NUMBER THIRTEEN

Subject—Oxy-Acetylene Cutting

1. *Explain fully which parts of an Oxy-Acetylene Cutting plant are different from a welding unit.*

2. (a) *If there is a difference in either of the regulators mention which one it is.*
(b) *What is the difference?*
(c) *Why is it necessary?*

1 and 2. (a), (b) and (c). (If question 1 is answered fully so is question 2.)

The torch, oxygen regulator and oxygen hose are the only parts of the apparatus that are different.

The torch has an extra tube for high pressure oxygen, which passes through a special hole in the tip.

The oxygen hose is heavier than the usual welding hose. The oxygen cutting regulator is so designed as to furnish a much larger amount of oxygen at a much higher pressure, than a welding regulator; this is necessary for heavy cutting; but for material up to ½ inch thick, the welding regulator may be used, although it will not give as good results, especially if the metal is rusty, painted, or otherwise coated.

In cutting, enough oxygen must be furnished to give a heavy enough pressure to blow the slag out of the cut, which amount is more than needed for welding, and the pressure must be higher for the same reason. Thirty pounds is the maximum pressure used for welding, while as much as 125 pounds is used for heavy cutting.

3. (a) *Is it possible to weld with a cutting torch?*
(b) *What precaution is necessary if this is done?*
(c) *Why isn't this process used?*

3. (a) Yes.

(b) All that is needed is to avoid using the high pressure oxygen jet, and use the preheating flame for welding. In some types of cutting torch, the Davis-Bournonville, for instance, a welding tip can be used, and by using the high pressure oxygen valve, a regular welding flame can be used. It is not a practice to be recommended.

(c) The cutting torch is too heavy and awkward, so that it is hard to do good work.

4. *Explain how cutting can be done with the welding torch if necessary.*

4. If the metal be heated red hot by any means, a jet of oxygen from the welding torch will cut it. But it makes a ragged job, as there is no preheating flame.

5. (a) *In cutting by the Oxy-Acetylene process, which does the cutting, the oxygen jet or the neutral flame?*
(b) *What action has the oxygen jet on the metal?*
(c) *What part does the neutral flame play in cutting?*

5. (a) The high pressure oxygen jet.

(b) The oxygen combines with the metal at the high temperature, turning it into oxide. The heat of combination melts the oxide, which the high pressure blows out of the cut.

(c) The neutral flame heats the metal to a high enough temperature for the high pressure oxygen to combine with it.

6. *Can Oxygen and Acetylene under sufficient pressure be made to cut individually? Explain fully.*

6. Neither oxygen nor acetylene will cut at any pressure, unless the metal is hot; even with hot metal, acetylene has no action. Oxygen does combine with iron at ordinary temperature, but very slowly, the result being rust. So that the cutting process is really only a kind of rapid rusting.

7. *Why is it specially important that armored hose be used on the oxygen line when making heavy cuts? (Give at least two reasons.)*

7. To keep the sparks from injuring the rubber, and to safely stand the high pressure. Armored hose for the acetylene should be also used in heavy cutting for the first reason.

8. (a) *How is a cutting torch lighted? Describe in detail.*
(b) *How is cut started on metal?*
(c) *How is torch in regard to metal being cut?*

8. (a) The acetylene is turned on and lit; the oxygen regulator having been set to the desired cutting pressure, the oxygen is turned into the heating jet till a neutral flame is produced; the high pressure oxygen valve is then opened wide, and the heating jet pressures adjusted, if necessary, till the flame is neutral. The high pressure oxygen is then turned off.

(b) The heating flame alone is used to bring the corner of the metal to a bright red heat.

(c) The piece being cut should be set, if possible, so the cutting tip can be held in a perpendicular position. This allows the slag to leave the cut freely. Cutting can be done at an angle, but the greater the angle, the greater the difficulty of getting a smooth and accurate job.

9. (a) *Is it possible to successfully cut cast iron?*
(b) *Wrought iron?*
(c) *Cast steel?*
(d) *Rolled steel?*

9. (a) No.
(b), (c) and (d) Yes.

10. (a) *Cutting can be done under water with ordinary cutting apparatus; why doesn't the flame go out when submerged?*
(b) *What additional equipment is generally used in under-water cutting?*

10. (a) and (b) The ordinary cutting torch is used, but there must be some means of surrounding the tip and metal being cut

In the April issue of The Welding Engineer, twenty lectures, as used by the Ordnance Corps, U. S. Army, Peoria, were published. The questions only were published, and the object of this article is to give our welder readers an idea of how a skilled welder would answer the questions. These answers have been prepared by Mr. S. W. Miller, of the Rochester Welding Works, Rochester, N. Y., who is, in the opinion of the Editor, one of the leading Welding Engineers of this country. The questions used are copyrighted by the U. S. Welding Co., Minneapolis, Minn. An article written by Lieut. Campbell, of this school, was published in the March issue.—Mackenzie.

with air, so the flame will not be put out, and so the combustion can take place. This is usually done by covering the metal with a hood, and turning into it a jet of compressed air, which displaces the water, and allows the cutting to be done.

LECTURE NUMBER FOURTEEN

Subject—Brass Welding

1. *Explain as fully as possible the chief characteristics of a good "filler-rod" for brass welding.*

1. It must be of such composition that the weld will be free from porosity, tough and strong. It must not have a brittle range at high temperature; that is, it must be possible to forge it at any temperature from a bright red heat down without cracking. It must flow freely, and unite easily with the metal being welded at as low a temperature as possible. It should give off as little zinc oxide as possible when being used.

2. *(a) Is a flux used in welding brass?*
(b) What is one way of making a good flux for brass?

2. (a) Yes.

(b) Ordinary borax is a very good flux, the only difficulty with it being its foaming when heated; and while this may be overcome by melting it in a ladle and powdering it, yet this takes more time than to use it without so preparing it, unless a large amount is needed. Then the material used by blacksmiths, which is already prepared, can be used.

3. *(a) What kind of a flame is used in brass welding?*
(b) Why?

3. (a) and (b) The neutral flame. (This is contrary to what is sometimes stated. The writer believes that the neutral flame is the best to use for all metals. The recommendation that an excess acetylene flame be used for certain metals is a relic of the days when torch flames were always strongly excess oxygen: for instance, one old style torch used 1.6 of oxygen to 1 of acetylene; in such a case it was necessary to use an excess acetylene flame, to be sure there was no oxygen present. Today any good torch can be used successfully with a neutral flame for any metal.)

4. *(a) In what position is the flame held in welding brass?*
(b) How should the "filler-rod" be held?

4. (a) The same as for any other metal. (See Lecture Number Nine, Question 7 (a).)

(b) The same as for any other metal. (See Lecture Number Nine, Question 7 (b).) (In the writer's opinion, there has been a great deal said about different methods of holding torches and welding rods, that is incorrect. His experience and observation are that all metals should be welded in the same way; that is, with a neutral flame; with as large a pool of melted metal as possible, and with the welding rod in the pool of melted metal, but not touching the bottom.)

5. *(a) Is it advisable to "V" out or burn out the ends of brass work to be welded?*
(b) Explain why.

5. (a) They should always be V'd, and never burned out.

(b) Because brass should never be heated any more than absolutely necessary, as the metal is damaged by excessive heat.

6. *(a) What causes the dense white fumes to appear when fusing brass?*
(b) What is cause of brass welds being porous?

6. (a) The volatilizing of the zinc in it; the fumes are zinc oxide.

(b) Volatilizing of the zinc and absorption of gases by the melted metal, which are given off when the metal solidifies; welding rod of proper composition will make welds that are not porous.

7. *Why should brass work not be disturbed when red hot?*

7. Because it is brittle at a red heat.

8. *What is the most difficult part of brass welding as a whole?*

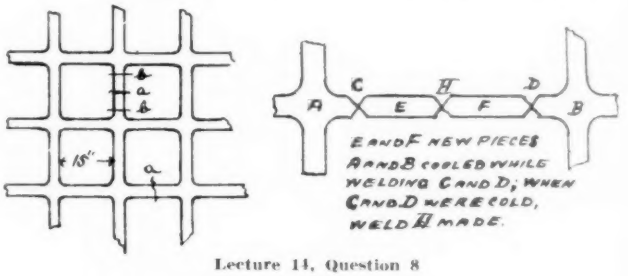
8. This is a hard question to answer, as there are many difficulties. The welding of brasses and bronzes successfully requires a knowledge of their chemical composition, and of the effects of the heat upon them. This latter is a very complicated technical matter, and no two alloys of copper and zinc or tin require the same heat treatment to get the best results. In addition, many other elements, such as manganese, iron, aluminum, silicon, phosphorus, lead, magnesium, and others, are added either alone or in combination, and in varying proportions, to make all kinds of alloys. It is impossible for a welding shop to tell what these alloys are without analysis; and even then, without wide experience, and further technical knowledge, it is not possible to tell the best way to handle them.

A very interesting illustration of the difficulties encountered and the knowledge required is the following, from the writer's experience:

A large and very valuable casting had been made in a brass foundry, of manganese bronze. The general design was a wide ring about nine feet in diameter, with a large hub in the center, connected to the ring by a lattice work of T section ribs; some sand holes had appeared in the casting, and the foundry tried to burn them in, but only succeeded in breaking the bars, because of the rigidity of the framework, the idea of which is shown in the sketch; the breaks were in about the location of A.

Inquiry showed that the alloy was about 70 per cent copper and 30 per cent zinc, with some iron, manganese and aluminum. This is an unusual manganese bronze, it generally being made on a basis of about 60 copper 40 zinc with the other elements in small proportions. All brass made of 70 copper and 30 zinc, and its derivatives, such as the manganese bronze in the above casting, have a critical range somewhat below 750° F., where they are very brittle; so that it is natural that the shrinkage after burning in or welding (and they had tried welding successfully) would cause the breaking.

The writer, knowing the above, and that a proper manganese



Lecture 14, Question 8

bronze alloy does not have this critical range, cut out the defective bars at B, leaving stubs about three inches long, to each of which was welded a piece of manganese bronze of proper composition, being careful to keep the other bars cool with wet asbestos. These pieces were about 4½ inches long, which left a weld to be made in the center of the bar. After the pieces had been welded to the stubs, as shown in sketch; the pieces E and F, and the weld H having no critical range, stretched under the shrinkage strain, but do not crack. The work was entirely successful.

Many alloys are seriously damaged by heating above or below their various critical ranges, or by sudden cooling from a high temperature. The knowledge of the peculiarity of the various alloys, and of their proper application to welding problems, the writer considers the most difficult thing to learn.

In the actual welding operation, given a good filler rod, the hardest thing to learn is to move as quickly as possible. The torch flame must not be kept on the metal an instant longer than needed. This means a large tip, and not much attention paid to smoothness of the job.

9. *Why are brass welds generally cooled in water as soon as fusion is completed?*

9. It is sometimes supposed to better the quality of the weld and of the heated material. A weld made with good filler rod has a tensile strength greater than that of wrought iron, and

tough and ductile; so as far as the weld is concerned, it does not need heat treatment.

Quenching some kinds of brass and bronze seriously injures them, so it is better to let the piece cool.

10. *Why is it difficult for the beginner to weld heavy pieces of brass?*

10. Because he does not use a large enough tip (which is hard to handle), and because he does not work quickly enough. The metal must be melted and added quickly.

LECTURE NUMBER FIFTEEN

Subject—Welding of Malleable Iron

1. (a) *Can malleable iron be successfully welded?*
(b) *What is the most successful method of joining two pieces of malleable iron?*

1. (a) Not with any iron alloy, if the original strength is desired. If it is only desired to fill up holes, or something similar, cast iron can be used very successfully.

(b) By welding with bronze.

2. (a) *What are three methods of detecting malleable iron?*

2. (a) It has a lower meeting point than steel welding wire, and when at attempt is made to weld it with such wire, the malleable iron will pull away with the wire, before the latter melts. The general appearance of malleable iron is smoother than cast iron, and there is seldom any sand on it. A small piece cut off with a chisel or hack saw is quite malleable, and not brittle, like cast iron.

For the benefit of welders who are liable to go to France, it is well to state that there are two kinds of malleable iron. The one used in the United States is what is called "blackheart," and the one used in Europe is called "white heart," the fracture of the former being dark, and of the latter light. They are made by slightly different methods, but the essential difference is that the whiteheart has all of its carbon removed and becomes a low grade steel, while the blackheart simply has the carbon changed in form, during the malleableizing process. White heart iron can be welded with steel filler rod. It is never made in heavy sections, the maximum thickness being about ½ inch.

3. (a) *What kind of "filler-rod" is used on malleable iron?*
(b) *Are "filler-rod" of malleable iron satisfactory?*
(c) *What kind of flux is used on malleable iron work?*

3. (a) Tobin bronze or manganese bronze of proper quality.

(b) No.

(c) With Tobin or manganese bronze, use borax.

4. (a) *How is a malleable iron casting prepared for welding?*
(b) *How hot should work be, previous to adding "filler-rod"?*

4. (a) *How is a malleable iron casting prepared for welding?*
(b) *How hot should work be, previous to adding "filler-rod"?*
(c) *What will occur if too much heat is applied?*

4. (a) It should always be V'd out, and all scale and dirt removed for ½ inch from the V.

(b) Just so hot that, after flux has been applied and run over the surface, a drop of filler-rod will run over the V as soon as applied; a bright rod is enough.

(c) If the iron is melted, it will return on cooling to its original condition as cast, that is, white iron, hard, brittle and weak.

5. (a) *In what respect does the adjustment of the flame differ on malleable iron from that of cast iron and steel?*
(b) *How is the flame held in relation to the work?*
(c) *Does the flame come in direct contact with the "filler-rod"?*

5. (a) and (b) In no respect. (See Lecture Number Fourteen, Questions 3 and 4.)

(c) If necessary to melt it, yes. The flame is placed where the heat is needed; if more heat is needed on the part being welded, direct the flame there, and vice versa.

6. (a) *Is more, or less, surface covered by the "filler-rod" on malleable iron than on cast iron?*
(b) *Why?*

6. (a) and (b) The question is not clear. If it is meant to ask whether a V the same size in each case would require different amounts of metal, the answer is that the same number of cubic inches would be needed, but the bronze, being heavier, would weigh more.

7. (a) *How should malleable iron be cooled?*
(b) *Is this the same as in welding brass?*

7. (a) It is safe to cool it slowly, though it is not always necessary.

(b) (See Lecture Number Fourteen, Question 9.)

8. *On what part of machinery does a welder generally expect to find malleable iron castings?*

8. The question is indefinite. Automobiles have many malleable iron parts, and the writer believes this is what is referred to.

9. *Explain carefully how a malleable iron automobile axle or transmission housing that has been cracked or broken, can be re-enforced so that it will be stronger than ever.*

9. The writer believes that a good weld in the parts mentioned will never give any trouble; but if extra strength is wanted, a strip of soft steel, welded with bronze all around, and applied as the reinforcement described for auto frames, will answer well.

10. *Describe very briefly how malleable iron is made and in what respect it differs from cast iron when cold, and also when under the influence of the oxy-acetylene flame.*

10. Chilled iron castings are used. These differ from grey, or ordinary, cast iron, in that they have no free carbon (graphite) in them, the carbon being in what is called the combined state. These castings are heated for several days at a high red heat, about 1,800° F., and this changes the combined carbon into a form of graphite called temper carbon. It differs from the graphite in cast iron in that the latter is in the form of curved plates, while the former is in small rounded masses, which makes the metal matrix tougher and stronger.

Malleable iron, when melted with the torch, shows cavities under the surface; this is probably due to the cast iron composing the center (it really is cast iron because it contains free carbon) melting before the surface which contains no carbon, and is, therefore, nearly pure iron.

LECTURE NUMBER SIXTEEN

Subject—Carbon Burning

1. (a) *Explain what is meant by carbon burning.*
(b) *In what respect is it used extensively?*

1. (a) Removing the carbon deposit from gas engine cylinders, by the use of oxygen, which burns the carbon up, just as coal is consumed.

(b) For cleaning automobile cylinders.

2. (a) *Will oxygen gas burn alone or does it merely aid combustion?*
(b) *Will carbon in a free state burn?*

2. (a) Oxygen does not burn. Burning of any material cannot occur unless oxygen is present, although oxygen cannot be said to support combustion. Combustion is the chemical union of an element with oxygen; it is sometimes slow, as in the case of iron rusting in the air; sometimes more rapid, as in the case of coal burning in a fire; and sometimes violent or explosive, as in the case of powder. In the first two cases, the oxygen comes from the air; in the last, from the chemicals in the powder.

(b) Yes. Charcoal and anthracite coal are almost entirely free carbon.

3. (a) *Why is it advisable to remove only the spark plugs and not the entire valve cap or "bonnet" when burning carbon in a gas engine?*

(b) *Can it be done either way?*

3. (a) To confine the oxygen so it will more easily combine with the carbon and not be wasted.

(b) Yes.

4. (a) *Does it makes a difference if the carbon is hard and dry in the cylinder?*

(b) *What will help in such cases?*

4. (a) It does not make a great deal of difference, but

(b) If a few drops of kerosene are squirted into the cylinder, it helps to support combustion.

The greatest trouble is found when the carbon is thin and in patches, because there is not enough of it to make the burning continuous. The dirtier the cylinder, the easier it is to burn it out.

5. (a) *If the cylinder is rather oily does this make a difference?*

(b) *Does the presence of oil aid or retard combustion?*

5. (a) and (b) Answered in 4 (b).

6. (a) *What precautions are necessary before carbon burning is attempted?*

(b) *How is asbestos paper used in carbon burning?*

(c) *Name a good substitute for asbestos paper when carbon burning.*

6. (a) The cylinder being burnt out must have both valves closed, and the piston at the top of the stroke; this prevents the oil being burnt off the cylinder walls, or flame passing back into the carburetor.

(b) To cover over the oily parts of the motor, so that the sparks cannot get to them.

(c) Anything that will take care of the sparks—sheets of tin are very good.

7. (a) *Is there any danger of warping the valves and overheating the cylinder and piston when burning carbon?*

(b) *What is the effect of carbon burning on aluminum pistons?*

7. (a) No.

(b) It has no injurious effect.

8. (a) *What pressure is used on the oxygen line for carbon burning?*

(b) *Will carbon burning regrind valves?*

8. (a) *What pressure is used on the oxygen line for carbon* needed, but with the size of tube generally used, the pressure given is right.

(b) (This question is evidently wrongly stated, and is possibly a misprint.) he point is that burning out does not make it necessary to regrind the valves.

9. (a) *How long should the burning be done?*

(b) *How often is carbon burning recommended for a gas engine?*

(c) *If there are any carbon particles or sand left in the cylinder after burning is done, how are they removed?*

9. (a) Till the sparks disappear entirely.

(b) It depends entirel yon the condition of the motor. Some automobiles will run 1,000 miles and be in good condition, and others need burning out after 500 miles. The well recognized carbon "knock" is the sign that burning is needed.

(c) A few rapid revolutions of the motor will blow all the dirt out of the exhaust.

10. *Describe how the carbon is removed from a four-cylinder engine, paying particular attention to details, such as lighting, which part of the head the torch is played on first, what does the burning and where the carbon goes.*

10. Four cylinder motors fire in either one of two orders—1, 2, 4, 3 or 1, 3, 4, 2, the numbers being the numbers of the cylinders, beginning at the front. It is necessary to know this before starting. Shut off the gasoline tank valve and drain the carburetor. Place asbestos paper around the carburetor and over the oily parts of the motor. Loosen all the spark plugs to make the motor turn over easily; set the piston of Number 1 cylinder at the top of the compression stroke, which will close the valves. Remove spark plug from Number 1 cylinder, drop a lighted match in the spark plug hole; turn the oxygen on slightly, and put the tube in the hole beside the match; this will start the carbon burning. Twist the tube into all the corners and cavities, so the oxygen will reach all the carbon. If sufficient volume of oxygen is furnished, there will be no trouble in burning the cylinder clean, no matter which part of the cylinder is attacked first, and the tube should be large enough to do this.

As soon as the carbon is gone, turn the motor over by hand one-half turn; this will bring the piston of either Number 2 or Number 3 cylinder to the top of its stroke, with the valves closed. Burn out this cylinder. Again turn one-half turn, which will bring Number 4 cylinder into position. After burning out, turn over again, which will enable the last cylinder, Number 1 or Number 2, to be taken care of.

Clean the spark plugs by scrapping, or with gasoline, taking them apart if necessary. Replace the spark plug, turn on the gasoline, start the motor, and speed it up two or three times to blow the loose dust out.

The carbon is burnt by combining with the oxygen, as described before, and passes off as carbon dioxide, or, as it is sometimes called, carbonic acid gas.

LECTURE NUMBER SEVENTEEN

Subject—Preheating Agencies

1. (a) *What is meant by preheating as applied to the oxy-acetylene welding industry?*

(b) *What are several fuels which can be used very successfully for preheating?*

1. (a) Heating before welding; usually by some other means than the welding torch.

(b) Charcoal, coke, wood, oil, city or natural gas.

2. *Name the three principal reasons why parts to be welded are generally preheated.*

2. To save the welding gases, which are expensive; to make a better weld; to take care, as much as possible, of the contraction of the weld.

3. (a) *Why is charcoal considered the best preheating agent for general welding?*

(b) *Why should it not be used to any great extent in closed rooms during the winter months?*

(c) *If used during the winter what precautions are observed?*

3. (a) Because it burns with a clear hot flame; it does not injure finished surfaces; it needs no blast to keep it lit; it heats gradually, and the piece can be cooled as slowly as desired.

(b) Because its combustion produces a large amount of carbon monoxide, a poisonous gas, which destroys essential elements in the blood. It causes a tired feeling, headache and chills; later it may make the patient unconscious. If a serious case develops, call a doctor at once; in the meantime get the person into the fresh air, and lay him down on his back, with the head raised enough to be comfortable. Turn the oxygen from a welding torch into his face, and use artificial respiration if necessary.

If any welder feels the first symptoms, he should at once stop work and get into the open air, and it is best to stop work for the day.

(c) Keep the room well ventilated at both top and bottom.

4. (a) *Mention two materials which are used extensively in building up ovens and doing the preheating.*

(b) *What kind of brick is used?*

4. (a) Brick and sheet iron.

(b) Firebrick.

(b) How much should cast iron be preheated?

(c) Brass or bronze?

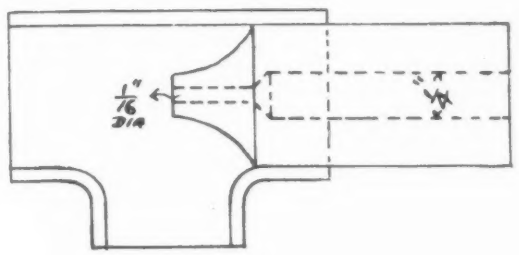
(d) Aluminum?

(b) and (c) The preheating temperature cannot be stated definitely. In general terms, the higher the preheat, the better and cheaper the results.

Frequently some pieces require more preheating than others. A piece of cast iron six inches square needs more than a piece one inch square; probably the latter would not be preheated at all.

In few welding shops is a pyrometer used, so it is not of much use to speak in terms of degrees. Again a piece of one shape will not stand much preheating, while another one will. Experience is the best guide; but as a rough idea, to be modified as circumstances govern, preheat cast iron red hot; brass and bronze not over the dullest red in the dark, and aluminum till a splinter made of half tin and half lead melts when rubbed on it.

Sketch and describe how a temporary brick preheating oven should be built, giving all dimensions, such as length, width and height and reasons for them.



Lecture No. 17, Question 10-A

6. Such a furnace may be of any dimensions, depending on conditions, and the writer does not se much point in the question as it is stated. The furnace should be built solidly, so it will not fall down, and large enough, as a usual thing, to permit the piece to be turned over or around, as may be necessary, without knocking the furnace down. This may, however, be necessary.

Explain how a cylinder block with a broken water jacket is set up for preheating; how oven is built for charcoal fire; how fire is started; how block is protected while welding and how it is returned to a cold state.

7. Set the cylinder, bottom down, on the table or forge, and tip it over until the bores stand at angle of about 30° from the vertical. Set bricks up on edge all around it as high as the top of the cylinder; scatter a few pieces of lighted charcoal under the bores ,and cover over with a sheet of asbestos paper. As soon as the cylinder is warmed through, add a little more charcoal, and from time to time increase the amount. When the cylinder is hot, turn the break so it will get the full effect of the fire; when it has arrived at the proper temperature, turn it so it can be welded, and cover the rest of the cylinder with asbestos, while welding. After welding, turn welded part into fire till it comes to a uniform temperature, and either pack in loose asbestos just as it is, or, if the break is not too serious, pack it in the asbestos bin to cool slowly.

8. (a) What precautions are necessary in setting up and preheating aluminum?

(b) If piece is to be turned while in the fire, what provision is made in building up oven?

8. (a) Care must be taken that the piece is so supported as not to distort when preheated. It must not be overheated; sometimes the preheating alone does no damage, but the additional heat of the torch may cause trouble.

(b) Make it large enough to avoid tearing it down; or so arrange it that it may be easily and quickly rebuilt.

9. In which cases is preheating absolutely necessary in order to make a satisfactory weld?

9. When the piece is heavy, or where contraction has to be allowed for.

10. (a) Give a sketch showing a preheating torch for use on illuminating gas and compressed air, which can be constructed very easily.

(b) Why are preheating torches not popular for general welding?

(c) Where are they used in numbers?

10. (a) The sketch shown is a common design. The 1/16 inch hole can be enlarged if necessary. Valves on the gas and air lines should be provided; the gas should always be turned on first and lit, and the air then turned on. In closing the torch shut the air off first. The writer does not believe in using compressed air for this purpose, as it is entirely too expensive. If any amount of preheating is to be done with gas torches, a blower of the Root type will operate much more cheaply, and with less initial cost for apparatus.

(b) The heat is sometimes too concentrated, and too quick. Also it may not be possible to cool off slowly enough. But many jobs can be done by their use more cheaply and quickly than with charcoal.

(c) For brazing.

LECTURE NUMBER EIGHTEEN

Subject—Aluminum Welding

(Part One)

1. (a) Is the welding of aluminum, more or less difficult than such metals ascast iron and steel?

(b) Explain why?

1. (a) It is usually said that it is harder than cast iron or steel. The writer cannot agree with this statement. When properly done, it is easy to do. The difficulty is to *learn* to do it.

(b) The trouble in learning is that the oxide film gets mixed up with the metal; because as soon as a fresh surface is exposed to the air, it is covered with oxide. The metals must be melted together *under* this film, and the puddling rod only used to break the film, and not to stir the metal together.

2. (a) Name the two methods of making aluminum welds.

(b) Can they be combined?

(c) Why?

2. (a) By using the puddling rod; and by using flux.

(b) and (c) The writer has never had any success in combining them; but he would not like to say it could not be done. He really does not see any use in the combination. He never uses flux for cast aluminum, and always uses it for sheet metal.

3. (a) What kind of a "filler-rod" is used in welding aluminum?

(b) is a flux used? Why?

3. (a) (It is probable that only cast aluminum is referred to.) Preferably in most cases an aluminum copper alloy, 92 per cent aluminum, 8 per cent copper. But sometimes pure aluminum is better; although not quite so strong, it is more ductile.

(b) The writer does not use it for castings, and he believes that most welders do not. His reason is that he can do the work more quickly without it.

4. (a) Is a cast or drawn "filler-rod" preferred?

(b) Name the two important metals which should be present and the percentage of each in the filler-rod."

4. (a) It depends largely on conditions and personal preference. With clean metal the cast rods are just as good as the drawn material, and cheaper. If clean cast rods cannot be obtained, the drawn wire is necessary.

(b) See answer to 3 (a) above.

5. (a) How should the flame be adjusted for aluminum welding?

(bq How is the flame held in relation to the work?

5. (a) Use the neutral flame.

(b) The same as for any other metal—so as to keep a pool of melted metal and keep the rod melting into it.

6. (a) *How is the "filler-rod" added?*
(b) *In what respect does this differ from all other metals?*
(c) *Why can this be done?*

6. (a) It should be added into the melted pool; but by moving it around against the edges of the pool, it will break the film of oxide, and allow the metal to run together. This should be done no more than absolutely necessary, as much stirring makes much oxide, and a weld full of laps.

(b) The melting point of aluminum oxide is very much higher than that of aluminum; the same is true of iron oxide and cast iron; while steel melts at a higher temperature than iron oxide. It is, therefore, necessary sometimes to rub with the cast iron stick when welding just as with aluminum; but it is not necessary with steel.

(c) (The question is not clear.)

7. (a) *Name the principal charcteristics of aluminum with regard to heat.*
(b) *What other metal acts in a similar manner?*

7. (a) It is a better conductor of heat than any of the common metals, except copper, but melts at a rather low temperature.

(b) Copper is the best heat conductor of any of the common metals, but while it melts at a lower temperature than cast iorn, its melting point is much higher than that of aluminum.

8. (a) *Is it necessary to "V" out aluminum for the same reasons as other metals?*
(b) *Explain why.*

8. (a) Not if it is ¼ inch thick or less. If ⅜ inch thick or over, it may be advisable to V it out.

(b) It is quicker to scrape the melted metal out than to V it; and usually melting and breaking the oxide film is sufficient to make a sound weld, with only a little added material. Of course it should be welded through.

9. (a) *Will an aluminum welding be as strong as the original?*
(b) *Give reasons.*

9. (a) As a general rule, yes; but not if the original is a rolled piece.

(b) Both original and weld in a casting are of nearly the same structure and chemical composition. Therefore, they have about the same strength. A rolled piece is stronger than a casting, so the weld is weaker.

10. (a) *What kind of a tool is used to aid in making an aluminum weld by most welders?*
(b) *How is such a tool made?*

10. (a) A puddling rod or stick.

(b) It is made from a piece of steel rod of suitable size, 3/16 inch to 5/16 inch diameter, with the end shaped to suit the work, and bent to the proper angle. The details are usually due to the personal preference of the welder. The writer uses a narrow spoon shape to pull the melted metal out, and a rather sharp pointed one to break the film, the angles being changed to suit the work in hand.

LECTURE NUMBER NINETEEN
Subject—Aluminum Welding
(Part Two)

11. (a) *What kind of files are used to finish aluminum welds?*
(b) *In what respect do they differ from the ordinary kind?*

11. (a) The so-called Vixen file is referred to.

(b) The teeth are always single cut and circular instead of straight.

12. (a) *In which hand is the welding torch held in aluminum work?*
(b) *In which, the "filler-rod"?*
(c) *The puddle stick?*

12. (a), (b) and (c) It depends on the welder. Some use one hand and some the other. Some use either. There is no reason why a welder should not learn to use both hands in welding any metal. He will find it of great convenience.

13. (a) *What materials are used to "back-up" aluminum work for preheating?*
(b) *Describe fully how aluminum is "backed-up" prior to preheating, in order to prevent the collapse of metal while welding.*

13. (a) It is not necessary to back up aluminum any more than any other metal; but it is at times convenient. A piece of sheet iron about 1/16 inch thick and shaped to fit, is very good. Any of the carbon or graphite blocks can be used; also there are clays and carbon compounds that can be molded to the proper shape.

(b) The sheet iron is fitted to place and blocked up so it will not move as are the carbon or graphite blocks. The clays and so forth, are molded to shape, and will dry out during the preheating.

14. (a) *How quick does the heavy coating or aluminum oxide form on a clean hot piece of aluminum?*
(b) *Will the metal flow together when this oxide is present?*
(c) *How is it overcome?*

14. (a) Instantly.

(b) Not if it separates the melted metal into sections; but it will run from the welding rod into the pool under the covering film.

(c) Break the film with the puddling rod.

15. (a) *Is it advisable to weld aluminum from one side only, or from both sides?*
(b) *Why?*

16. (a) Both sides.

(b) To get a sound weld.

16. (a) *In preheating aluminum with charcoal, what precautions are taken in setting-up; in starting the fire; during the welding operation, and in cooling the piece?*

16. (See Lecture Number Seventeen, Question 8 (a).) As in all other cases, the fire should be started slowly and gradually increased. The piece should be handled carefully, to avoid breaking it; it should be kept covered to avoid changes of temperature and cooled slowly.

17. (a) *Are preheating torches played directly on aluminum work?*
(b) *What kind of an oven is used?*

17. (a) and (b) Preheating torches are too severe for aluminum, in the writer's opinion. A charcoal fire on a forge is better. Gas burners in many cases are very good.

18. (a) *Is it necessary to heat the whole of an aluminum crank case if one part has to be preheated?*
(b) *Give reasons.*

18. (a) and (b) Sometimes yes; and sometimes no. There is no difference between an aluminum crank case and a cast iron one in this respect, in fact, any broken part has to be considered as an individual problem.

19. (a) *Are clamps used to hold parts in place on preheated aluminum?*
(b) *Explain why.*

19. (a) and (b) If the clamps would be liable to crush the heated part, they should be used with great care; if away from the part being welded, they may cause no trouble. Their use is to be avoided, unless absolutely necessary.

20. *When starting to weld a cold piece of aluminum, the flame is brought in contact with the work and held there much longer than on a similar sized piece of steel before any apparent change occurs. How is this accounted for, knowing that aluminum has a much lower melting point than steel?*

20. It has a higher heat conducting power than steel, and so it requires a larger amount of heat to bring it to the required temperature for welding than its melting point would indicate.

LECTURE NUMBER TWENTY

Subject—Aluminum Welding

(Part Three)

21. (a) *Explain fully why it is necessary to employ greater speed in the welding of aluminum than on any other metal?*

21. All metals should be welded as fast as possible. Speed is a relative term. If lineal feet per minute is the basis of comparison, two 1/16 inch plates can be welded faster than two 1/8 inch ones. Any low melting point metal can be welded at a faster rate than a higher melting point metal of the same thickness provided the same size tip can be used.

The writer is not at all sure that it is possible to weld aluminum faster than cast iron of the same thickness, provided equally good welds be made. As far as any *necessity* for welding aluminum faster is concerned, he does not see that it exists even admitting its possibility.

22. (a) *What is retort cement?*
(b) *How does it differ from ordinary clay?*
(c) *For what purpose is it used in aluminum welding?*

22. (a), (b) and (c) The writer is not familiar with the material. (See Lecture Number Nineteen, Question 13.)

23. (a) *When performing an aluminum weld by the puddle system, is the welder dependent upon the flame; the "filler-rod" or the puddle stick, for the fusion of the metal?*
(b) *Give explanations.*

23. (a) and (b). The question appears foolish in its present form. But it may be that the author desires to impress on the student that the metal must be melted before the welding rod or puddling stick are used, lest their premature use make matters worse instead of better. Sometimes such a question is thought necessary to bring out a point, but the writer does not agree, and thinks the form of the question should be changed.

24. (a) *What method of welding is used when executing a vertical weld on aluminum?*
(b) *Why is not the other method used?*
(c) *Is the vertical welding of aluminum to be avoided?*

24. (a) The puddling method.
(b) The flux breaks up the film and the metal runs away.

25. (a) *Can aluminum welds be made overhead?*
(b) *Explain why.*

25. (a) Yes.
(b) The writer can see no point to this question, in view of the answer to (a).

26. (a) *Is the same method used on aluminum as in cast iron in welding from the closed end, toward the open?*
(b) *Is this procedure necessary on preheated work?*

26. (a) Yes.
(b) Yes.

27. (a) *If a suspension arm, of a "U" type, on an aluminum crank case were to break about three or four inches from the body of the case, could it be welded in place without dismantling the motor?*
(b) *Explain in detail how such an arm should be welded.*

27. (a) Yes.
(b) Begin at mottom on one side, weld up to the top; begin at the bottom of the other side, weld up and across the top. Care should be taken to protect the body of the case with several thicknesses of asbestos paper, from the direct action of the flame.

28. (a) *Due to the contraction and expansion it is very difficut to have the bolt hole, in the end of an aluminum suspension arm that has been welded, return exactly to its former position. How is this difficulty provided for?*

28. Weld the hole up and redrill it in the proper place.

29. (a) *Should a section of an aluminum crank case be missing, it would be advisable to build up a new part with the "filler-rod" or to cast a new part in a mold and and then weld it in?*
(b) *Under what conditions should the above be done?*

29. (a) and (b) It depends on circumstances; if a casting could not be obtained soon enough, it would be necessary to fill the hole in. If the hole were small, it should be filled in. If the hole were large, a casting would be cheaper and more quickly welded in.

30. (a) *If it were found that an aluminum crank case after being welded, had one corner about 1/8 inch lower than the rest of the case and it had not effected any of the bearings, could it still be reclaimed?*
(b) *Give procedure.*

30. (a) and (b) The low spot could be built up with entirely satisfactory results.

A NOVEL ELECTRIC WELDING PROCESS

J. Sauer, in the Electrotechnischen Zeitschrift describes a new German process of electric welding which is said to be particularly useful in the case of broken T-rails, Z-shaped steel and iron, wheel felloes and similar metallic pieces of irregular cross-section. When such objects are heated to welding temperatures, it is usually found that the thinner parts are burned away before the thicker reach welding temperature.

To overcome this difficulty and at the same time to obtain a very complete weld, Sauer uses a welding machine in which the two pieces are gradually brought nearer and nearer, until sparks form an arc between the surfaces to be welded. The heating proceeds gradually until the melting point is reached, when the pieces are forced against each other. The ridge of metal formed at the junction must be removed with a chisel, while the weld is still red hot. If the welder attempts to forge the ridge flat by hammering, parts of the metal are pressed into the welded joint and the strength of the weld is greatly impaired. Welds made by this process have been found to have 98 per cent. of the tensile strength of the metal itself.

The process has been adopted by some of the large toolmakers for welding tool-steel tips to shanks of a lower grade of metal, and has been greatly improved by the addition of an artificial "breaking" of the weld before it cools. The two pieces of metal are welded as described above, but while the weld is still red hot, it is pulled apart, the current being shut off temporarily and again welded under pressure and heat. Steel tools made by this method have given satisfactory service, and the scarcity of tool steel in Europe renders the process of special interest.

—American Machinist.

NEW FRENCH BOOK

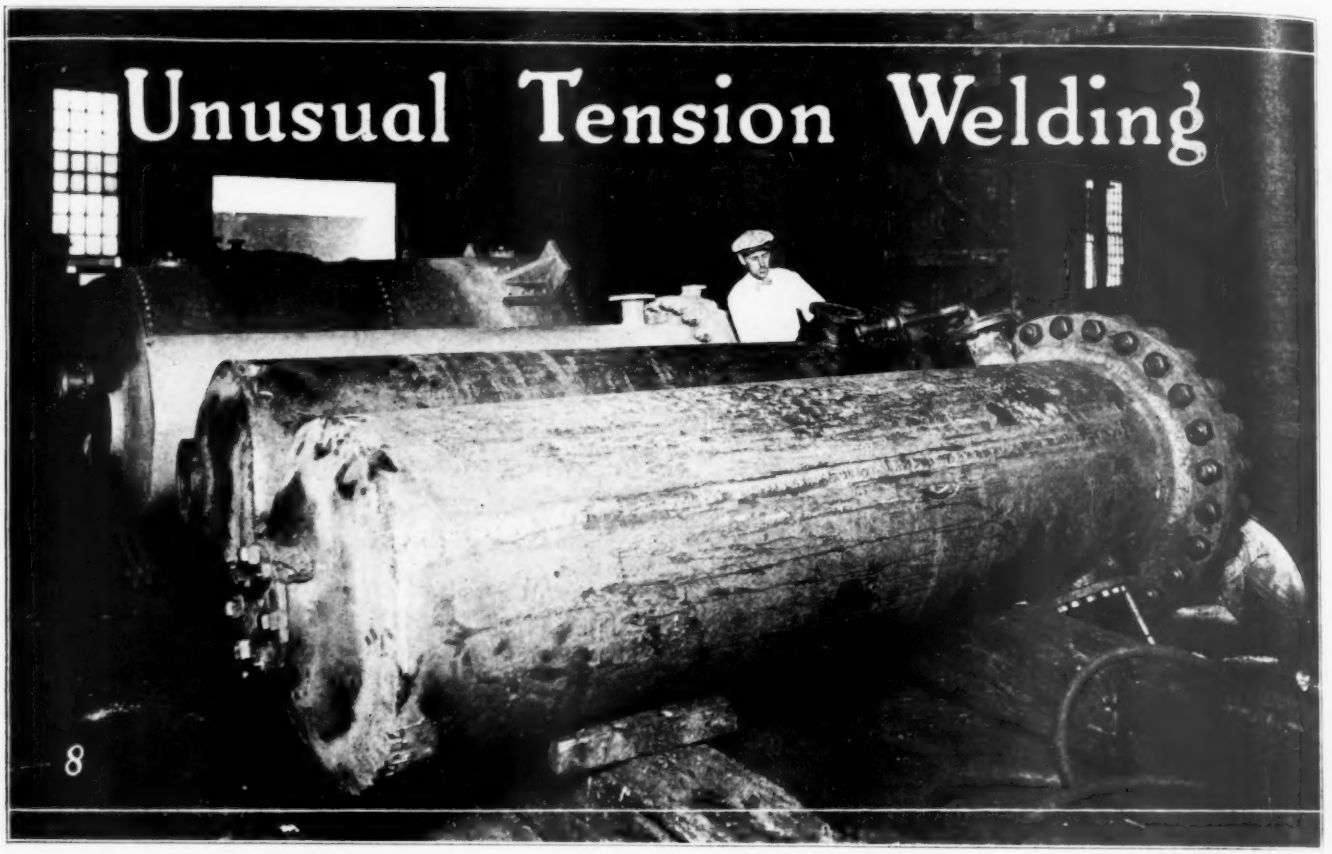
The Autogenous Welding Union has just published under the title: *"The Autogenous Welding of Lead"* an elegant pamphlet on the different procedures employed today for autogenous welding of lead. It originates principally from the application of welding lead in the construction of lead chambers employed for the manufacturing of sulphuric acid. The principal procedures described are: Hydrogen and blowing, hydrogen under pressure and oxy-acetylene. Numerous illustrations are shown in the pamphlet.

This work forms part of the collection of the publications of the Central Office of Acetylene and Autogenous Welding Union, 104 Boulevard de Clichy. Price, 2 francs, *postpaid*.

Arc Welders Wanted

For service in building ships. See advertisement elsewhere in this issue.

Unusual Tension Welding



PROBABLY no branch or division of the mechanical world has witnessed a more rapid growth and development during the past three years, and particularly since the United States went to war, than the welding industry. Wherever there are production or repair problems, there you will find a welding system of some sort helping to sovle the problem. Mechanical men who previously looked askance upon oxy-acetylene welding have been compelled, because of the wonderful results being secured, to revise their opinions. It is now an established fact that necessity, the mother of invention, has become a sort of big sister to the welding torch. After the war, when thousands of plants now making war materials are converted back to their original purposes, the lessons of the welding torch will be remembered and put to peaceful purposes.

Tension welding is a subject about which there has always been more or less controversy. Some authorities have held that from a production standpoint such work should not be attempted, but the recent demonstration of a Chicago shop conclusively dispels this argument.

The Chicago plant of the Davis-Bournonville Co., was recently confronted with the problem of securing a large number of 5 inch Morterud Heaters. Because of the nature of the chemicals used in the heaters it was found that riveted heaters were unsatisfactory and it was decided to weld them by the Oxy-Acetylene method. Both Boiler-Makers and welding experts considered the plan impracticable, but under the supervision of Mr. Fred J. Maeurer, Superintendent of the Chicago shops of the Davis-Bournonville Co., these welded Heaters are being turned out in large numbers. Not only has it been found that they can be welded cheaper than they can be constructed in the old way, but in use the heaters are giving entire satisfaction. Up to the present time not one failure has developed.

At the top of the first page (Fig. 8) a battery of three of these Morterud Heaters are shown, and attention is directed to their workmanlike and finished appearance, particularly the third one, which has received a coat of paint. The appearance of the heaters in this photograph should be compared to the heater shown in Fig. 9, which was riveted.

In Fig. 1 the method of preparing and cutting Flue Sheets is illustrated. "A" shows square plates before cutting. "B" shows two flue sheets, after they are cut in circular form. 85 holes are drilled in these sheets for tubes. "C" shows outside cut on plate for flange, and also illustrates the cutting of the inside with the Radiograph. "D" shows the completed flange, ready for machining. The diameter of the outside cut is 45 inches, the inside being 30 inches. The thickness of the plate is 2½ inches. The cutting speed per minute is 6 inches, using a No. 1 A Radiograph.

Fig. 2 shows a close-up view of the cutting operation. Fig 3 shows three welders at work on different parts of the heaters. The man at the right is welding a shell. Attention is directed to the fact that this operation (welding the long seam) is being handled as a one man job. On the inside of the shell, at the far end, a jack is in position. As the seam progresses the operator eases up on the jack, always maintaining an opening of about ¼ inch at point of welding. To keep the two edges of the shell level a bar is inserted at far end of shell (see illustration) with a counterweight on the end of bar. This bar may be shifted from side to side, so that shell edges are always even. A helper was heretofore used for this work. The operator in the center of Fig. 3 is welding the outlet flange to the bottom, while the operator on the left is welding the inside of flange. All connections and flanges are welded on both sides, to prevent the solution which is used, to get in seams and start corrosion.

Fig. 4 illustrates the welding of flanges on shell. The flange was cut as shown in Figs. 1 and 2. The length of shell is 11 feet 6 inches, thickness 7-16 inch, diameter of shell 30 inches.

Fig. 5 shows the welding of an inlet nipple on side of heater. In this illustration the flange is welded on, the side seam is welded, as is also the outlet connection on the bot-

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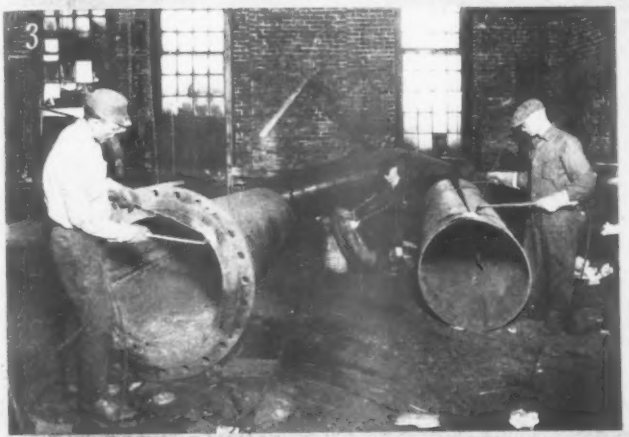
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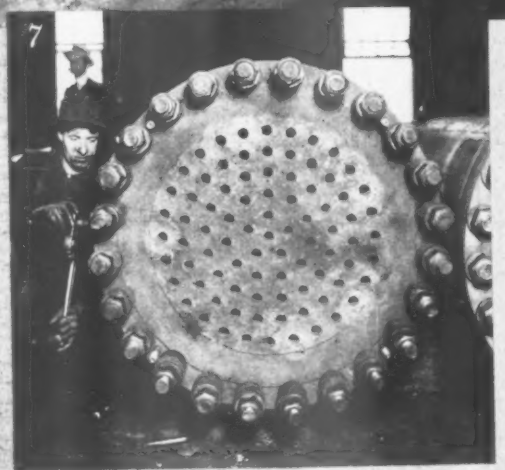
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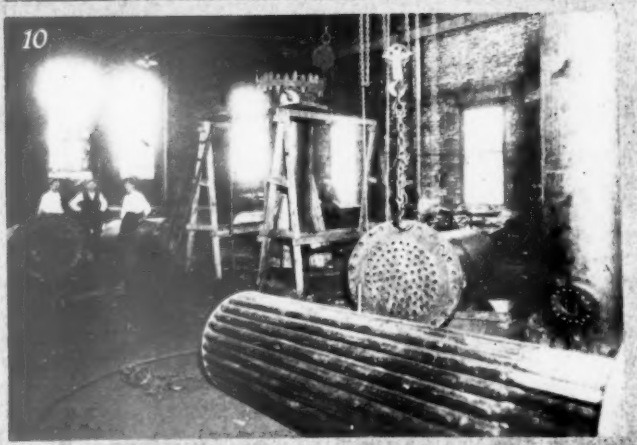
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tom. This view illustrates the size of the heaters and shows the excellent outward appearance of the welded seams.

Fig. 6 shows a flue sheet, drilled for 85 one and one-half inch tubes. The illustration shows about one-half of the flues welded, work not being started on the other half. Attention is directed to the fact that the holes for tubes are beveled ¼ inch. The tubes, before welding, project about ¼ inch. This allows the operator to so direct his flame that the heavy flue sheet is properly brought into fusim with the lighter flue. This method of preparation is responsible for the excellent results secured.

Fig. 7 shows the appearance of the tubes after welding. The clean, finished character of the work is evident. Fig 10 is another view of tubes ready for test.

When welding is completed these heaters are subjected to an air test of 110 pounds. All welds are then saturated with soap and water and are then tested with cold water to 280 pounds (Hydrostatic test) before being accepted by Government officials.

To Mr. Macurer belongs the entire credit for the success of this important work, the details of which were worked out by him.

Arc Welders are Needed

for ship construction. Write the Editor, or see advertisement in this issue.

NEW DEPARTURE IN PREHEATING

By J. B. Diehl

In these dire times, when the nerves of practically every industry in the United States are being tried to the uttermost; when the conservation of fuel and all other unnecessary consumption of the vital forces of industrial institutions is the paramount care of those who would see this war quickly and finally won; when every ounce of speed and efficiency has its own significance, and with the welding trade bravely struggling under the terrific burden. With tons of machinery being made every day, and tons and tons more still to be built, does the individual welder fully realize the enormity of the task that is at hand, and the grave responsibility that rests upon his work?

At this time, when efficiency is perhaps the very first requirement, when so many new men are coming into our ranks to help shoulder the gigantic burden we are expected to bear, could there be a more appropriate time to show the "Younger brothers" how the "t" may be taken out of can't? Was there ever a more fitting occasion than now to tell how so many difficult jobs can be made comparatively simple?

Looking back to the pioneer days, veteran welders will recall the discouraging problems which beset them—the pulley that would crack a spoke or two despite the best of care in welding; the cylinders that persisted in warping; the crankcase that just would crack seemingly through sheer obstinacy. Nor will they forget the malleable casting that was thought to be cast iron, and after being welded was full of blowholes and had only the strength of cast iron in the repair. This is the position of the new welder of today.

While they did not have the advantage of books and trade journals then, as the new man of today has, it has been proven that the average welder will notice and absorb a practical shop kink article and just glance over an article that may be excellent, but laden with technical terms.

Therefore we are face to face with the fact; that if the practical shop kink article is the more applicable for the man that requires assistance, how is he going to learn your method of doing that difficult job if you keep it in your head?

Mr. Welder, do you realize that in these present times we must make every weld count? Lives are daily depending upon the strength of our welds, repairs at the front, which must be certain and rapid would undoubtedly be facilitated by the valuable little kink you have learned.

Just think what it may cost by sending that cylinder, crank case or other parts out welded apparently sound, but with that deadly strain concealed from the eye; probably human lives.

Your shop kink articles, under present conditions will doubtless help in innumerable ways by placing your experience before thousands of eager readers, thus bringing oxy-acetylene welding to a point of efficiency and standardization that will facilitate the production of machinery and material so urgently necessary to the successful consummation of this war.

Every man who has ever used a blowpipe knows the uncertainty of his welds unless precautions are taken for the proper expansion and contraction of the metal.

A preheating device under control that would insure an even expansion of parts to be welded, it is understood has never been placed upon the market until lately.

The writer at this time will endeavor to start a drive of "Shop Kink Articles" that will be oversubscribed far beyond all expectations, by discussing a new type of preheater that should and will eventually be in every welding shop. In this discussion, the motto will be "Impartial to all methods of preheating, and each upon its own merits."

Charcoal, which we have always held as our mainstay for preheating cylinders, crankcases and general work owing to its heating qualities and unlimited area which may be covered by it, has several bad features that are eliminated by this preheater.

The fumes arising from burning charcoal are poisonous to the operator, not to mention the annoying smoke. Flying sparks are a menace to the building, and it is difficult to keep a charcoal fire burning evenly. Where there is a good draught the fire will burn freely, but in the absence of draught the action is vica versa, making even expansion difficult. The non-control of the fire after being started is also an obstacle on various kinds of work.

Considerable time is consumed in building a brick furnace for the charcoal and getting the fire burning right. With the present cost of this fuel, the preheating expenses is a large item, and then the uncertainty of a slow, even contraction.

When necessary to use charcoal, it should be ignited and allowed to burn until an even fire is obtained. If the casting is then placed over the charcoal, the expansion will be more even and less time consumed in heating. Where there are a great number of jobs to be welded continuously, it is necessary to build as many brick structures, using valuable floor space and causing considerable dirt.

It would not be inferred that charcoal is to be eliminated entirely, as it is an excellent heating agency for some classes of work, therefore its annoyances will have to be tolerated when necessary.

There are several splendid preheating torches on the market using kerosene, gasoline and artificial gas, in fact, indispensable to the welding trade, but with a limited scope.

There are numerous jobs that cannot be handled by a blow-torch, owing to the small amount of space covered.

(Continued on page 28)

Preheating Revolutionized

Absolutely Even, Continuous Heat at ⅓ Fuel Costs

The day of the charcoal fire, with its trouble, uncertainty, sparks, and fumes, is gone. The danger of fractures from uneven contraction is practically eliminated. Welding may now be done safely and quickly under a steady, even, continuous heat that may be controlled and adjusted to any kind of work. Fuel costs are reduced to one-third the usual figures. Twice the amount of work can be turned out under the same shop conditions. Two or more men may work at the Preheater at the same time. Burying is entirely eliminated.

THE WIEDERWAX PREHEATER

one model of which is illustrated below, is a continuous heating medium which is ready for the heaviest kind of work in a few minutes. Gas, natural or artificial, gasoline, or kerosene (as conditions may warrant) is used for fuel, doing away entirely with charcoal.

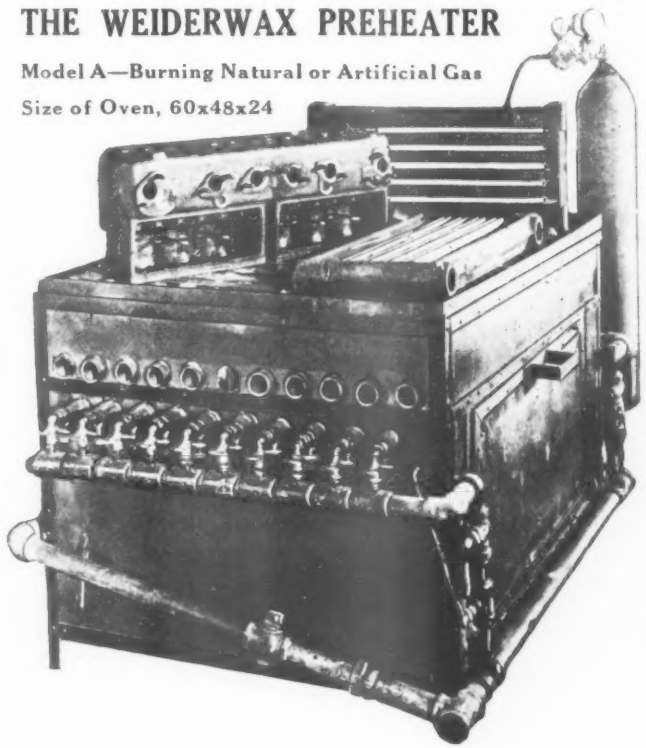
Operation of the WIEDERWAX PREHEATER is simple, the heat controllable at all times. The casting is placed upon the top of the Preheater, the burners lighted, and in a very short while it is ready for welding.

Specially constructed burners supply the heat to a heat absorbing element between the burners and the top of the furnace; this element heats to a cherry red, giving off a steady even heat. After the welding is finished, the operator leaves the piece in place until it has been allowed to reach the proper heat for removal for cooling. It is then placed in the asbestos lined oven underneath, protected from all draught, and allowed to cool. In a very short space of time, it is ready for delivery to the trade.

THE WEIDERWAX PREHEATER

Model A—Burning Natural or Artificial Gas

Size of Oven, 60x48x24



Model A Is Built In Five Different Sizes.
Also May Be Specially Constructed for Special Work

Saves Time—Saves Money
Prevents Cracking
Makes a Clean, Healthy Shop

Tested for Seven Months

The **Wiederwax Preheater** has been tested for seven months by practical welders, who, in that time have not used an ounce of charcoal for preheating purposes.

One of these tests was made with 122 cracked radiator sections. One man, working continuously, without stopping to build or nurse charcoal fires, preheated these sections at a cost of 5c each. He did the work in half the usual time, with 1-3 the usual cost of fuel. Only four of the 122 sections cracked, and these through carelessness.

Automobile cylinders were preheated to the right temperature for welding in fifteen minutes, welded, and delivered to the trade 2½ hours later.

From 20% to 35% of acetylene and oxygen was saved on pieces that under ordinary circumstances would have been welded without preheating.

The cost of the **Wiederwax Preheater** was saved in six and one-quarter months—just on fuel alone.

WRITE FOR FREE BOOKLET

Don't waste any more time on charcoal fires. Bring your shop up to a high point of efficiency by installing this remarkable preheater at once. Write today for our instructive little booklet on "Modern Preheating Methods."

FILL IN THIS COUPON AND MAIL TODAY

GEIST MANUFACTURING COMPANY, DEPT. X.
2001 Atlantic Ave., Atlantic City, N. J.

Gentlemen: Kindly send me free of charge booklet on "Modern Preheating Methods."

Name .....

Street and No. .....

Town or City ..... State .....

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Waste of Paper.

IN a recent issue of a National Weekly a country editor makes some interesting remarks concerning the waste of good white paper. The cost of paper and printing is a matter which interests every man who reads, as does also the cost of postage. Our country friend says:

"I print about eighteen columns of reading matter a week. On an average I receive weekly, with a Washington postmark, about twenty-eight columns of reading matter, all with a plain notice on the top of the proof sheet, or in an accompanying mimeographed letter, that it is my patriotic duty to publish it and help win the war. I want to help win the war; but I have signed contracts to publish some advertisements in my paper and my subscribers expect some local news. Crowding it any way I know how, I could print only a little of this material.

"I don't like to cast an aspersion upon any of the two hundred and sixty-five patriotic associations and commissions that send the material out by rejecting its plea while publishing the material from others. And who am I, to discriminate among the departments and bureaus of the Government? Seems to me I'm bound to assume that one is just as patriotic and necessary as the other.

"So, as I can't print it all, I reluctantly throw it all in the wastebasket. I hate to do it—especially when I consider what I am paying for white print paper. If they'd only send me a quarter as many pounds in the form of blank sheets they would certainly help a lot to win the war right around in this immediate locality. Glancing over this material from time to time I find that it has a good deal to say about the vital need of co-ordinating things. Co-ordination eliminates waste and promotes efficiency. I was going to cut out a collection of paragraphs on the need of co-ordination, paste them on a sheet and send it round to a couple of hundred or so of my Washington contributors with the simple suggestion that they try the medicine themselves. I would cheerfully give them a couple of columns weekly if they would get together and decide on what should be printed. But on second thought it seemed they might consider the suggestion flippant or in bad taste. Merely as a matter of curiosity I should like to know what the white paper, the printing and the postage come to—and how much of the total output goes into the wastebasket."

Conservation of Energy.

IN a recent issue of *Power*, an interesting communication from a stationary engineer was given space to point out to his brother engineers that the brotherhood had been missing many a good bet by lack of knowing more about welding and what oxy-acetylene welding can accomplish in the boiler-room.

In our profession (and today it *is* a profession as exact as law or medicine) it is a splendid thing to endeavor to help the industries of our beloved country in which we all are best fixed to help.

To preach the conservation of energy, time, man-force, money, is a form of patriotism that appeals to every man with red blood in his veins. We ask that you who know what scientific and practical welding means, to do your part in extending to the steam power plants of our country, a force for good and right that is too much neglected today.

SAVES MONEY BY ARC WELDING

Arc-welding has been brought prominently before the public through the fact that it was used to restore the broken engine castings of the interned German ships. When breaking these castings the Germans thought they could not be repaired, and that it would require a year or more to replace them. However, even before the ships could be otherwise overhauled and made ready for transport service the broken castings had all been repaired and were good as new. This achievement has impressed the value of arc-welding upon the minds of many shop managers, and in many plants castings and other parts of apparatus which in the past would have been scrapped as hopelessly damaged, are now perfectly restored by the arc-welding process at small cost and great saving of time.

One large manufacturer, working on munitions, has installed a Westinghouse arc-welding equipment for the sole purpose of making tools for turning shells.

Ordinarily these tools are made from high speed steel and cost about $12.00 each. This manufacturer uses high-speed steel for the tip of the tool only, welding it to a shank of carbon- or machine-steel, and in this manner the tools are produced at a cost of $2.00 to $4.00.

For several weeks this plant has been turning out 240 welded tools per day, the men working in shifts of four, which is the capacity of this outfit.

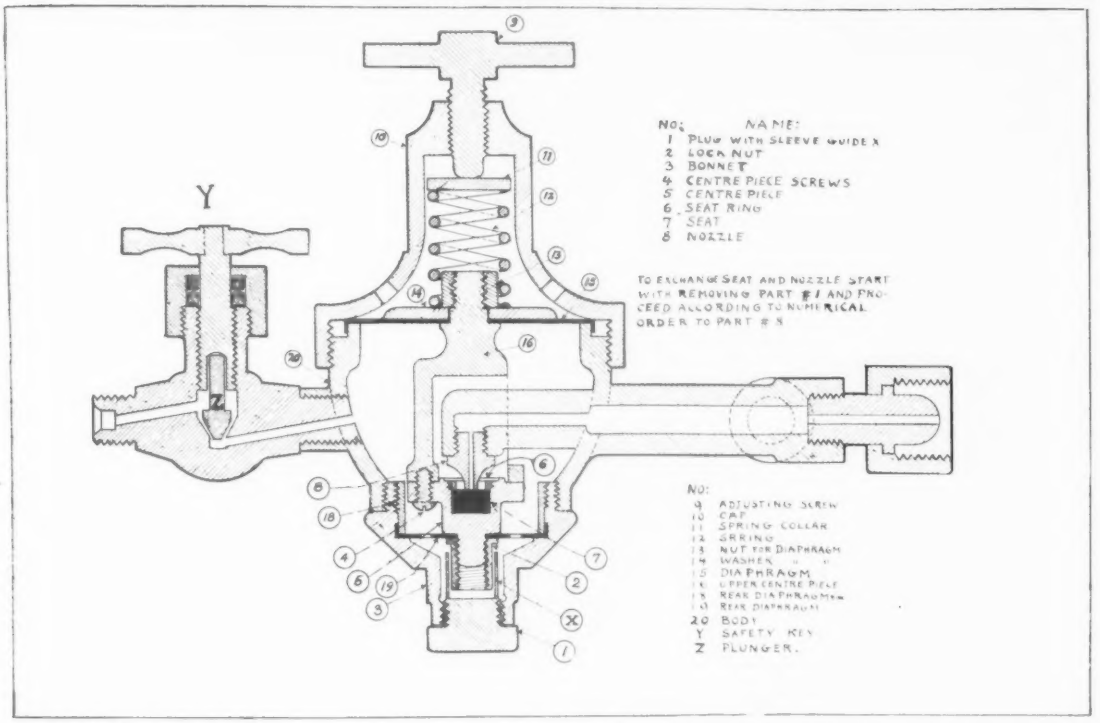
The equipment consists of a 500-ampere arc-welding motor-generator with standard control panel and three outlet panels for metal-electrode welding, and one special outlet panel for the use of either metal or graphite electrodes. This special panel is intended to take care of special filling or cutting processes which may be necessary from time to time, but it is ordinarily used in the same manner as the other panels, for making tools.

These four panels are distributed about the shops at the most advantageous points for doing the work, it not being necessary to have them near the motor-generator or main control panel.

For toolmaking, which involves the hardest grades of steel, a pre-heating oven is used, not because it is necessary for making a perfect weld, but because otherwise the hard steel is likely to crack from unequal cooling, and also because preheating makes it easier to finish the tool after the welding process has been completed. For ordinary arc-welding operations the pre-heating oven is never used.

GENERAL WELDING & EQUIPMENT CO.
G.W.&E.Co.
107 MASS. AVE. BOSTON, MASS.

G.W.& E.Co.--STANDARD--REGULATOR



DESCRIPTION: The more the welding and cutting gets into general use, the more people begin to discriminate about the various parts of an equipment, and they want to know the details of construction before placing new orders.

REGULATORS are one of the principal items people begin to look over closely, as a great deal of worry, delays and even accidents can be avoided by a careful selection.

We, therefore, give here a full description of our Regulators. Nearly every regulator has a main diaphragm (15) to which is screwed on a centerpiece (16) which carries a seat holder (5) with seat (7) pressing against outlet nozzle (8) of the high pressure gas. With adjusting screw (9) the regulator can be set to deliver gas through nozzle (8) maintaining automatically the desired pressure.

The principal features of a perfect regulator, however, is that the seat (7) invariably keeps absolutely the same relative position to nozzle (8). In our Regulators, the movable centerpiece (16) with seat holder (5) is, therefore, not only tightly screwed onto the diaphragm (15), but also to perforated diaphragm (19) by means of lock nut (2).

In this way the movable centerpiece can only move straight up and down. The rear diaphragm will also prevent the main diaphragm from buckling as it prevents any side strain. It will, furthermore, lessen the strain on the main diaphragm through its immediate counteraction up as well as down. It acts not only as an absolute alignment, but also as a both-way acting spring.

Furthermore, the end of the seat holder slides in a thin slotted sleeve guide (X), so as to add to the forcible and frictionless guide. It goes by itself that such a regulator will keep in perfect condition for years, as the whole inner system, and especially the main diaphragm is guarded against side strains and bucklings. The only thing to do is to exchange the seat (7) and nozzle (8) whenever there is any wear. But with the new seat and nozzle, you are assured that the regulator is as good as new. Any other regulator shows a strained or buckled diaphragm sooner or later, and is hard to reseat, if at all possible.

WHAT we claim for our REGULATORS is:

PERFECT, FORCIBLE AND FRICTIONLESS ALIGNMENT. DIFFERENTIAL SPRING ACTION PRODUCED BY A DOUBLE DIAPHRAGM SYSTEM. QUICK, SENSITIVE AND ACCURATE REGULATION. NO STRAINING OR BUCKLING OF MAIN DIAPHRAGM, THEREFORE, QUICK AND RELIABLE RESEATING.

The outlet valve (Y) of the Regulator contains a floating plunger (Z) which allows the gas only to flow out, but not in, the plunger closing the valve automatically when there is back pressure, thus preventing the body of the regulator from filling up with an explosive mixture.

Many thousands of these REGULATORS are in constant use, and the description easily shows why.

(Continued from page 24)

the flame. By using a larger flame the heat would be too intense and the expansion too rapid.

On some types it is necessary to keep the air pressure up in the tank by means of a hand pump. Again we have the brick furnaces to build, replenish the fuel supply when exhausted (generally in the midst of welding) constant attention to the burners and the question of slow even contraction.

There have been numerous other appliances placed upon the market, but as these have not proven as good as the above mentioned it would be superfluous to take them up.

There has been no little hesitation in placing the subject matter of this article before the readers, having realized that there were ethics in trade journalism that could not be lightly set aside; and entertained not a little fear that the readers might misunderstand the motives. But the time now is so short, and the work to be done so great in quantity, and so important in quality that it is believed that ethics can safely be waived this once for the sake of unusual value to the welding trade of the subject under discussion.

Upon looking back—only eight months—the daily charcoal fire seeme like a horrible nightmare, leaving a feeling that prompts the writing of this article to enlighten others.

Last November, by coming in contact with two well known gas engineers it was learned that they had invented a preheating furnace that would revolutionize the welding business. Realizing the urgent need of a furnace that would be of such a benefit to the welding trade, arrangements were made to give it a fair trial. The result is that after eight months hard usage, which has been highly satisfactory, the writer takes the liberty of stating that this furnace is the missing link.

It is called the Wiederwax Preheater, and is understood to be on the market now.

Simply stated, it is a continuous heating medium with a controllable heat, with a positive draught free oven for even contraction. These are being built in different sizes and type applicable to any shop. Height, three feet, length, and combination coal and gas. The scope being unlimited for manufacturing as well as repair work.

The preheater mentioned above is an artificial gas burning type applicable to any shop. Height, three feet, length, four feet, width three feet with a large asbestos lined oven where castings are placed after welding. There is no blast used, the gas flowing through specially constructed burners which send the flame upward through the silica at the top of the furnace. In a few minutes this silica becomes red hot, giving off a heat that may be regulated at will by means of valves, insuring more B. t. u.'s from the gas than any other method.

One of the first advantages noticed was that from three to six pieces (depending upon the size) could be heated at one time, allowing two or three men to work on it simultaneously with no furnace preparation whatever.

It is simply a matter of lighting the burners (the lighted area and quantity of heat being under control of the operator) and placing the castings upon the silica top of the furnace.

In approximately fifteen to thirty minutes, depending upon the size of the pieces, they are ready for welding. As fast as one job is finished, the cover is taken off the next piece which is ready for welding. The first piece is then placed in the oven for cooling. This oven reaches approximately five hundred degrees Fahrenheit, shuts off all draught and allows slow even contraction.

Some idea of the value and efficiency of this furnace may be gathered from the fact that in the early part of this year the firm with whom the writer is connected took a contract to weld one hundred and twenty cracked radiator sections from one of the government barracks, at a figure that would save fifty percent of the purchase price; the cracks being from ten to fifteen inches long and running from one to six cracks per section. With the prevailing cost of charcoal and labor this would have been an utter impossibility. Fortunately, by having this preheater, one man worked two sections at one time, welding one while the other was heating. As fast as one section was welded, it was put in the oven and replaced by another section. Out of one hundred and twenty, four of these cracked and required rewelding.

Cost of preheating was five cents per section, not to mention the time that was saved by being able to work from one section to another without interruption.

Do you know of any other method of preheating that can show a record such as this? Illustrations such as this should be enough to prove to the executive as well as the practical welder, for whom this article is written, the remarkable efficiency this furnace can deliver. But as further proof, we will go a little farther on the savings this furnace effects, and explain how it does it.

In the first place, it takes from one-half to one hour to build and get a charcoal fire burning right (a blowtorch also takes considerable time). This preheater is instantaneous. Right in this very first operation it has saved from forty to sixty percent of a man's time.

This preparation work is generally carried out by a helper, but it must be acknowledged that all delays tend to retard the welder, making the cost of the work higher. Besides the absolutely even heat the furnace gives off, the workman welds steadily and economically without stopping to bother about new fires or whether the piece that has been welded is cooling properly.

Practically speaking, all danger from cracking is eliminated by the draught free asbestos oven.

Now then, every welder knows that a number of jobs are welded without preheating, due to the time and trouble required to start a charcoal or any other fire and the loss of time in waiting for the casting to get hot. To weld a piece without preheating necessarily means the consumption of more oxygen and acetylene. The ease with which such pieces can be heated on the preheater, or even included with a larger piece while heating, naturally does away with this cold welding. On such jobs it has been found that the saving was from twenty-five to thirty-five percent.

It may be conservatively said that the saving per month using this preheater means labor cost cut in half, with one-third the former fuel cost and at least twenty-five percent on oxygen and acetylene, with contraction cracking practically eliminated.

Isn't this truly a wonderful invention for the welding business?

We welders, all of us, owe it to our Government in its time of trial, to make our shops as highly efficient as possible, and our work as perfect as it can be made. It is in this spirit only, in this conviction only, that the writer has taken the liberty of submitting this article and with assurance that any information of assistance within his limited experience will be gladly given if desired.

PATENT INFRINGER SENT TO JAIL FOR CONTEMPT.

Eldon J. Perry, of Lansing, who was fined $1,000 several days ago by Federal Judge Tuttle for contempt of court was taken to the Detroit house of correction for six months, Tuesday. Perry is alleged to have infringed upon patents of the Prest-O-Lite company by refilling containers used by that firm. An injunction against him was granted by the federal court sometime ago and it is charged that he continued to refill Prest-O-Lite tanks. For this action he was fined $1,000 for contempt of court and given seven days in which to pay the money. Having failed to pay his fine Perry was sent to jail.—Detroit *Free Press*.

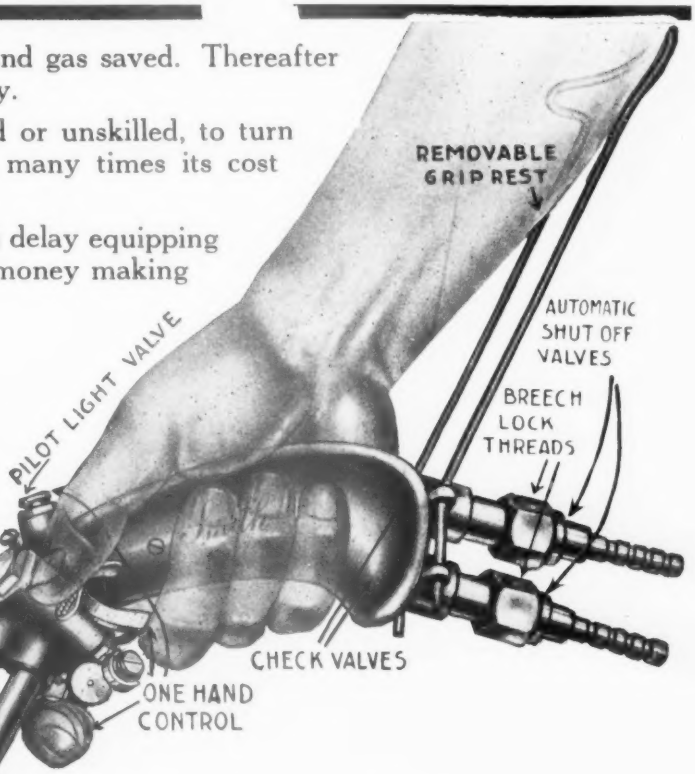
Get This Torch

It will quickly pay its cost in time and gas saved. Thereafter it will pay you a net profit every day.

It will enable your operators, skilled or unskilled, to turn out better work. It will be worth many times its cost to your business.

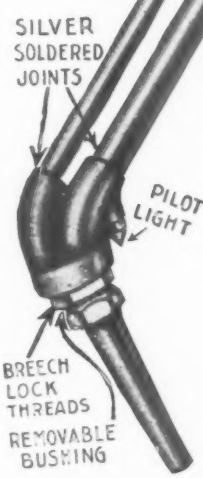
You are losing money every day you delay equipping your shop with this money saving, money making tool.

This Is The Lowest Priced High Grade Torch Made **$33.75**



SMITH'S PISTOL GRIP WELDING-TORCH

(For Overhead Work We Make This Torch With a Much Straighter Grip)



One Hand Control. The proportion and volume of gases may be varied instantly, by the hand holding the torch. Lay the torch aside for a minute and the flame is turned out. No gas is wasted. Pick it up, and by the time the torch is over the work it is lighted and the flame adjusted. No time lost even if the work necessitates adjustment of the flame every few seconds. Never need to use two hands on torch, work progresses without stop.

Pistol Grip and Arm Rest relieve operator of fatigue, leaves the wrist in a normal position, and makes the one-hand control entirely practical.

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ELECTRIC ARC WELDING APPLIED TO CAST IRON

By B. W. Bowers.

WELDING cast iron by the electric arc chas been characterized by many gray iron foundrymen and those concerned in machining such welds, as a problem of uncertain results due to the lack of knowledge of the nature of iron and the proper methods of procedure. Since cast iron fuses at a lower temperature than steel, the heat treatment, as applied in welding, is an important factor and must be borne in mind, if good results are to be obtained. There are two methods of welding cast iron with the electric arc, namely, by the metallic electrode and the carbon electrode. Each method has its limitations and work to be welded should be governed accordingly.

Metallic Method of Welding

By the metallic method, almost any defect or break can be repaired or remedied, providing the casting is clean and of good gray iron. A steel wire, from ⅛ to ¼ inch in diameter, generally is used as filling in material by the metallic method. Some grades of cast iron are of such poor composition, that it is almost impossible to weld them by either process. The metallic method has played a prominent part in welding cast iron for marine and railroad service, especially where tensile strength is essential. It imparts so little heat that the strains, which are usually set up by electric welding, are not considered detrimental. While it must be admitted, that it is a slower process than the use of the carbon electrode, it has many advantages over that method. Work can be welded in position without dismantling, whether overhead, vertical or horizontal.

For iron foundries and machine shops the writer is of the opinion that the carbon electrode possesses advantages over the metallic process. However, in these plants the metallic electrode should be available, as there are numerous defects that can be welded to better advantage than with the carbon electrode. The writer intends to discuss the carbon method as applied to foundry work for repairing defects due to shrinkage, sand spots, broken corners or lugs and defects that appear during machining.

The range of work adapted to carbon welding is somewhat smaller than that of steel, due to the numerous difficulties effected by the sudden expansion and contraction of the metal in the welding area.

The most common faults with carbon welds on cast iron are hard spots due to the lack of adequate heat and proper filling-in material. Overheating expands the metal near the welding zone, resulting in small cracks. The majority of these difficulties can be eliminated easily, if the work is given careful consideration and by exercising the necessary skill and taking all possible precautions. The greatest drawback to welding cast iron with the carbon arc is that soft welds cannot always be assured on defects that are over 4 inches in area. To obtain a soft weld, the filling-in material must be kept in a liquid state until the weld is completed and should be covered immediately with hot sand to retain the heat. On defects larger than 4 inches in area, the flame of the arc cannot play over the entire surface at one time, which robs the weld of the proper degree of heat. Therefore, the metal is chilled and this results in hard spots. Defects larger than 4 inches should be welded by the metallic method, especially where tensile strength is an important factor. However, welds have been made on cast iron with the carbon arc, that showed a greater tensile strength than the original metal, but as such results could not always be repeated, it should be considered as possible, but not probable at all times.

Welding a Defective Casting.

To follow the process carefully, it might be well to illustrate the welding of a defective casting. It will be assumed that a shrink hole is to be welded, 3 inches in diameter and about 1½ inches deep, the section of metal being about 3 inches thick. First, the defect must be cleaned out, removing all foreign substances, such as oil, grease or sand. This should be done with a pneumatic tool and should not be burnt out by the electric arc which would cause unnecessary strains and possible hard spots. The weld is actually cast by the arc and must be made in molds cut from graphite or other carbon material, enclosing the defect. Graphite is preferable to carbon having a lesser tendency to cause porous welds and is considerably cheaper than the other material. Burnt graphite crucibles can be used to advantage. The mold is made to conform to the outline of the defect and is cut about ⅛ or ¼ inch larger than the width and length of the section to be repaired. The mold should be from ½ to ¾ inch high and is set over the defect as shown in Fig. 1.

All cracks and crevices must be closed with a paste made from two parts of pulverized carbon and one part of silicate of soda (liquid glass) to prevent the molten metal from spreading, during the progress of welding. This paste is spread around the outside of the mold and is pressed against both casting and mold, as shown in Fig. 2. When the heat strikes the paste, it hardens and holds the mold tightly in place.

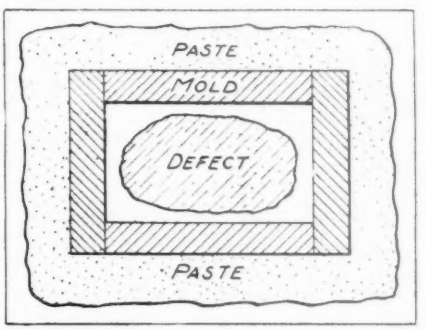


Fig. 1—Plan View of Mo'd Surrounding the Part to Be Welded.

Preheating the Casting.

It is necessary to preheat cast iron prior to welding, in order to relieve the strains set up by the application of the arc. If the section to be welded is thin, a little warming is sufficient. Preheating the casting can be accomplished by a gasoline torch, allowing the defect to store enough heat to burn a pine stick. After preheating, the welding operation must be commenced immediately to avoid the loss of heat that has been stored in the casting. The filling-in material should consist of sticks about ⅜-inch square, cut from coarse-grained charcoal pig iron, not recast. Sticks or rods that have been recast chill and are hard, resulting in blowy, unmachinable welds. The pig iron must be high in silicon, which leaves the weld in a soft condition. The welding material should be low in manganese and sulphur, the following analysis giving excellent results:

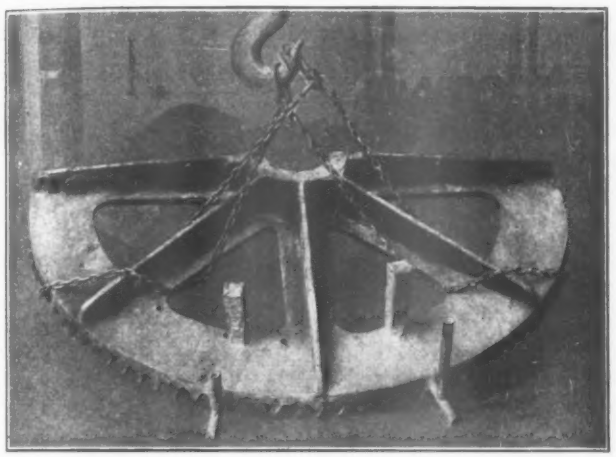
	Per cent
Combined carbon	3.20
Manganese	0.26
Silicon	3.86*
Sulphur	0.018
Phosphorus	0.036

*As high as 12 per cent.

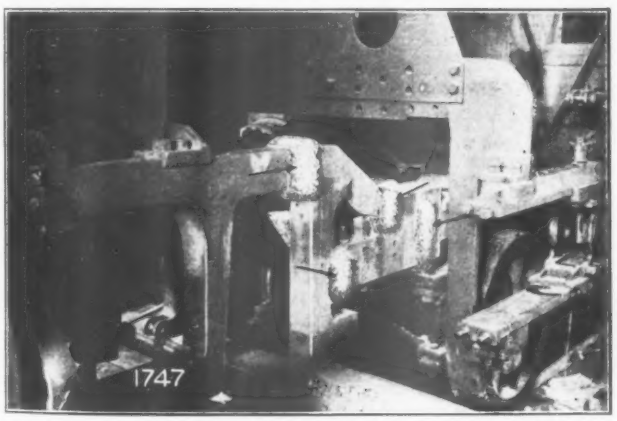
The filling-in material is used in the same manner as when welding a steel casting with a steel wire or rod.

When welding large defects the pig iron sticks may be broken into small pieces, approximately ¾-inch long. Several pieces are laid into the defect and melted, which may be repeated until the molten metal is near the surface, when feeding with the stick can be resumed. The metal must be kept in a liquid state throughout the welding operation and should not be allowed to cool as this produces hard spots. Therefore it is essential that the weld be completed with

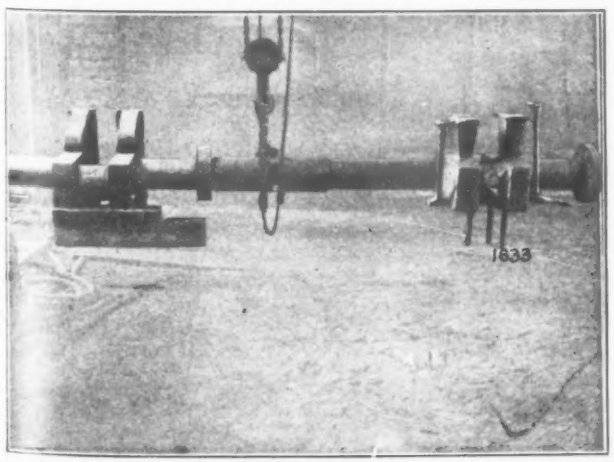
New neck cast on to large roll made with the aid of Thermit and having the pods cast in at the same time.



Large bevel gear on which two new teeth and crack have been repaired.



Four Thermit welds on locomotive frame on the Missouri Pacific Railroad, made without removing the frame from place.



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interruption. Sharp carbons for the electrode are recommended, to concentrate the flame at a narrow point, thereby eliminating an irregular and fluctuating arc. The current for a weld of this size should be about 400 amperes. Ordinarily, it should range from 350 to 500 amperes, according to the size of the defect. The filling-in material must be added until it rises to the top of the mold, providing a riser of ample size. Immediately after the weld is completed and while the metal is still liquid, it must be covered with fine, hot sand to a thickness of about 3 inches to retard cooling as much as possible.

Care must be exercised in preheating cast iron to relieve the strains properly. Small, light cylindrical castings, such as piston rings, should be warmed all over and the proper degree of heat should be applied at the part to be repaired. A cracked or broken spoke in a gear wheel must be warmed all over, since the rim usually is heavier than the spoke and has a tendency to crack further or at another place, if the strains set up by preheating are not considered. In this case it is advisable to start the preheating directly opposite the defect, so that the heat will gradually flow to the defect by radiation. Apply the heat to various parts of the wheel for a short time and the part to be repaired is heated last. Large defects, having a metal section more than 3 inches thick, should be preheated by a charcoal fire; a retaining wall of fire brick is built around the defect and is held in place by steel angles clamped to the casting. At least two

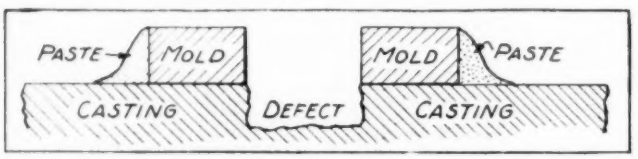

Fig. 2—Cross-Section of Mold Extending Above the Defect to Form a Riser Over Part to Be Repaired. Lecture 14, Question 8.

bushels of charcoal should be spread over this area and a slow fire should be started. The fire should be given sufficient time to distribute its heat by radiation throughout the casting. After one hour or two the fire should be urged until the metal around the defect is hot enough to burn a pine stick. This is a temperature of about 700 or 800 degrees Fahr. Then the charcoal can be removed and welding should be started immediately.

Lugs or bosses may be readily welded to iron castings with entirely new metal. The mold is cut out to fit the lug or boss pattern snugly and is blocked or clamped in position. The welding metal is melted the same as for any other defect.

Welding Cracks.

Cracks in cast iron are not easily welded as they usually extend further when the heat is first applied. Frequently a ¼-inch hole is drilled at the beginning of the crack and extending beyond its depth to check further rupture when the heat is first applied. The crack then is cut out to a v-shaped slot by a pneumatic tool. This method can be applied to cracks not over 4 inches long. Larger cracks should be chipped out and welded with the metallic electrode, which applies a lower degree of heat.

Fluxes are not absolutely necessary, but can be used at the operator's discretion. The majority of prepared fluxes contain an abundance of iron oxide which produces a sticky slag and simply adds to the operator's troubles to eliminate it.

Small blow-holes frequently develop in cast iron welding and a small amount of sodium chloride (common salt) added while welding, will eliminate the gases which seem to be the cause for this sponginess.

In welding cast iron the following suggestions should be observed:

1. Defects should be cleaned or cut out with pneumatic tools and not burnt out by the electric arc.

2. Molds enclosing the defects must be tight, allowing no molten metal to escape. They must be cut higher than the surface of the casting to allow a good-sized riser which aids in retaining the heat adjacent to and at the weld, insuring soft metal in the weld. Slag and other impurities rise into this head which is cut off after the weld is cold.

3. Preheating must be applied in the proper area to relieve the strains and should not exceed 700 or 800 degrees Fahr.

4. Proper preheating, the right welding heat and heat retention are important.

5. Sharp carbons for the electrode are essential in eliminating a fluctuating arc.

6. Current supply should not be less than 350 amperes and not more than 500 amperes, according to the size of the defect.

7. Filling-in material must be cut from charcoal pig iron (large grained) in the raw state. It must not be recast into strip form. It must be high in silicon and low in manganese and sulphur.

8. Welding must begin immediately after preheating and must be completed without stopping.

9. A little sodium chloride (salt) added occasionally, will eliminate small blow-holes.

10. Immediately after weld is completed and while the metal is still liquid, cover with fine, hot sand and let it remain covered until it is entirely cold.

—The Foundry.

FORMULA FOR RODS.

Editor:

Kindly give me the proper formula for welding rods for welding brass castings made of the following: 88 per cent copper, 10 per cent tin, 2 per cent zinc. All new metal is used —no scrap. A. Welding Wks.

Answer:

We know of no rods on the market which would give you the proper color which you are after, and if we were doing this job, we would have the foundry cast us some rods of the same material, being careful to have them entirely free from sand and manufactured from pig metal, no scrap being used.

Because of the very high percentage of copper in this material, it is essential that you use the utmost care in welding, in order to secure a good bond, and one in which the weld will not be noticeable in the appearance of the casting.

It is advisable to preheat your casting to a red heat before starting the weld, in order to secure fusion without burning out the zinc and tin. Keep the cone of the flame from touching either the casting or the rod and secure fusion as rapidly as possible. Editor.

WELDING GRATES

I. M. G.: In reply to your letter of recent date, regarding the welding of grates.

The welding of grates should be considered as white iron and they are difficult to be welded. However, with the proper welding rod and flux, one can make a fairly good weld by the following method:

The blowpipe should be played on the clean edges to be welded, until the metal is at a bright red, but without melting. Then sprinkle a little flux on the surface. Again heat the edges, keeping the white jet of the metal until melting of the iron takes place. As soon as the first fusion is obtained, the welding rod powdered with the cleaning flux, is applied without digging and thus build on a coal of grey iron on each edge of the weld. It will then be easy to continue the weld the same as for grey iron.

Are you sure you are using pure vanadium steel rods for steel castings? I would rather prefer steel welding rods for shafts or steel gears. Editor.

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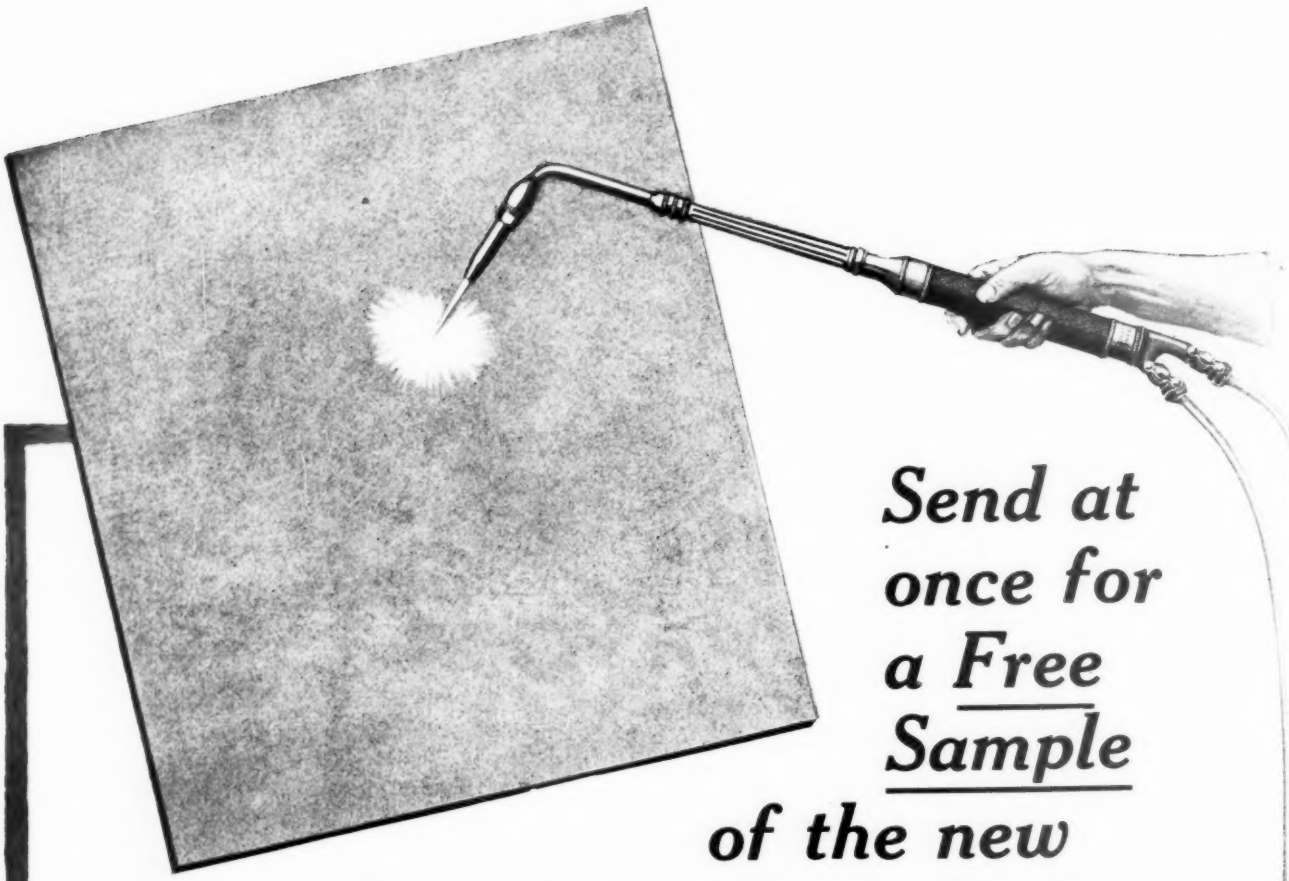

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NEW WELDING TRUCK

A new truck for the welding shop has been placed in the market by the Universal Oxygen Co., of Sheboygan, Wis. This

truck is rugged in construction and, as will be noted from the illustration, embodies many new features. Prices will be furnished on request.

THE WIEDERWAX PREHEATER

A new preheating device, which embodies many new principles and which will prove a valuable part of the welder's equipment, has been placed on the market by the Geist Manufacturing Co., Atlantic City, N. J. A feature of this new preheater is the speed with which work can be handled, with economy of fuel. In fact, the device will pay for itself in a short time. A more detailed description of the preheater is given elsewhere in this issue (advertising section) and further illustrations and information will be published in the August issue.

NEW REGO CATALOG

The new "Rego" catalog, issued by The Bastian-Blessing Co., Chicago, and which describes welding and cutting apparatus, is ready for distribution. It is handsomely printed and illustrates all types of torches, regulators, etc.

CARBON FOR WELDING

The National Carbon Co., Cleveland, Ohio, have published a useful little booklet which tells about the use of carbon in the arc and oxy-acetylene welding processes. Carbon products are made in several forms for the welder and this little booklet contains many useful hints and suggestions. A copy will be mailed upon request.

WELDING FLUES

Editor:—I will try to outline my way of doing the flues, and I may say that I have done over 1,000 by now.

The first that I did was for our own shop boilers, 3-inch flues and they have been in use close on to two years now, and I found out later that I had brought the time down to less than a half on the old way in the fire.

I am a blacksmith myself, I have charge of that department. I am sure the oxy-acetylene process does a neater, easier and better job, if it is done right. I introduced it on the above job and had all kinds of trouble promised from small leaks to blowing up of the boilers.

I was troubled at first as to how to keep the ends on square with the rest of the flue, until I found a hollow scrap cast iron table about 6 ft. 6 in. long in which I got V's cut in at the ends and made two more V's out of angle iron to set in the bottom of the casting, so that I can move them to any length of flue. Then at the right hand end about 4x8 in. away I put two more, but fastened them down. The two end V's hold the short pieces to be welded on in line.

I find that there are very few straight flues after they have been in a traction engine, so I always turn the flues until the highest point is at the top, then raise the other end until I get a level on 4 V's. I weld about 3/8 in. and turn over and start welding from the other side. I find this way keeps them as near in line as it is possible for a bent flue to be.

I do not bevel them at all as I think as our friend Mr. Bolles says, it is not necessary, but I always run them on the emery wheel to take the scale off that the Rambler or Rattler has left on, for there is one of the dangers of faulty welds in flues, when you have to burn the scale off which gets incandescent and will not always yield to the force of the gas, thereby burning the flue at that point. I hold the torch about 60 degrees and turn the flue away from me as I go on with the welding, using 1/8-in. filler and No. 3 or 4 Prest-O-Lite tip on 2-in. flues, which are the sizes I mostly use.

My consumption of oxygen is a little under 1 atmosphere per flue. My work is mostly on traction engines and fittings which covers quite a range of work from boiler fire box patches to engine cylinders and gear wheels.

J. Lofthouse.

WELDING PIPE

Editor: We have been requested to tender our services to weld cast iron fittings to wrought iron pipe, carrying 150 lbs. steam pressure. The fittings are slipped on the pipe and welded in place, so the specifications read. The pipe is all sizes from 3 inches up to 12 inches, and the people desiring the work done before, but cannot tell us of any places where such work is in service in this country. We do not believe we can weld here, and do not want to experiment, but we do want to learn something. Can welding be done here, if so what method should be used? Or, can you suggest a procedure to get the desired end, that is to hold the flanges on the pipe and make them steam tight?

We would say in passing that we appreciate your magazine very much. C. W. W.

Answer: You are correct. This is no welding job. Of course the cast iron flange can be welded to the pipe, using a cast iron rod as the feeding in material, but such a bond will be very brittle—far more brittle than cast iron. It is obvious that such a bond is not dependable and the stress set up by expansion and contraction of the pipe in service would probably fracture such a weld.

There are two methods open to you. The first one is to have steel flanges made and welded to the pipe, or the cast iron flange can be pinned to the pipe in two places by means of a bolt or rivet and then brazed. The latter method, of course,

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is not a welding job nor is the use of the oxy-acetylene flame advisable but oil burners or air-gas flames used in conjunction with a fire brick furnace to heat the flange and pipe to a sufficient heat so that your flux and spelter will thoroughly bond the flange to the pipe. A brazing job of this kind well executed will unquestionably be steam tight and very strong.—Editor.

CAPTAIN J. Q. MACDONALD

The subject of this sketch is "Captain J. Q. MacDonald," who is a product of the West, where he received his early training and later became the leading Metallurgist and Chemist connected with the largest copper companies in the country. Captain MacDonald became Chief Engineer of the National Oxygen Company early in 1916 and served in that capacity until August, 1917, when the urge for the necessity of trained men in the World's War induced him to make application to the Second Officers' Training Camp at Fort Sheridan, Illinois, from which he graduated with the rank of "Captain in the Ordnance Department," and

CAPTAIN J. Q. MACDONALD

immediately upon the completion of his duties at Fort Sheridan, he embarked for France, and, upon his arrival there, was put in charge of an Ordnance and Supply Division with Headquarters in Paris, from which point he operates one hundred (100) enlisted men and twenty (20) odd officers, who he has scattered at various munition depots, ordnance factories and supply stations.

Captain MacDonald's duties consist of the inspection and receiving of all Ordnance munitions and supplies coming from England, Switzerland and Spain.

Captain MacDonald has had previous military experience as he held the rank of Colonel in Colorado during the Cripple Creek strike and, for some time, was Military Secretary of the State of Colorado, having served under the famous General Sherman Bell.

Captain MacDonald numbers among his intimate acquaintances the majority of the more prominent mining people of the country and is also regarded highly in both the Chemical and Engineering Professions.

Captain MacDonald made his home in Chicago for several years prior to his entry into the war, and his very large number of friends both in Chicago and Detroit feel a very keen interest in his welfare and are certain that he will reflect great credit upon himself, the army and the United States.

RED CROSS WELDING SCHOOL

The American Red Cross, Institute for Crippled and Disabled Men, 311 Fourth Ave., New York, is starting a course in oxy-acetylene welding.

The name of the Atlantic Welding Co., 30 Church St., New York, has been changed to the Lincoln Raie Welding Co.

Frank C. Hasse, who has been District Superintendent of the Oxweld Railroad Service Company, has been commissioned as Captain in the Quartermasters Corps of the National Army.

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The information here presented on the subjects of oxy-acetylene welding and cutting has been mainly furnished by S. W. Miller, proprietor of the Rochester Welding Works, whose wide experience in the practical application of the process, and whose success in the work, vouch for the reliability of the information here placed on record. The experience of the author in the oxy-acetylene welding field has been unusually extensive, but having been mostly on repair work, he has written especially for those engaged in a similar line. A great deal of the work done with the oxy-acetylene welding torch is on repairs, and while there are also a great many applications of it in manufacturing work, such applications are more or less special in each case, and sometimes require a great deal of experimenting before success is attained. The general principles here presented, however, apply equally to repair and manufacturing work. This volume describes the equipment required for oxy-acetylene welding and cutting, deals in detail with methods used in welding cast iron, malleable iron, steel, copper, brass, bronze, and aluminum and gives in addition, special attention to the welding of sheet metal, tank welding, boiler repairs, etc., as well as to the subject of lead burning, which is a special kind of autogenous welding.

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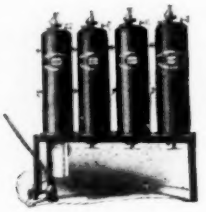

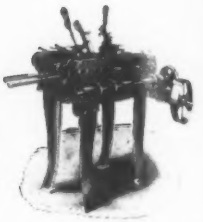

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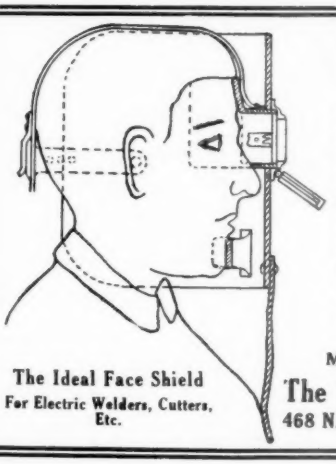

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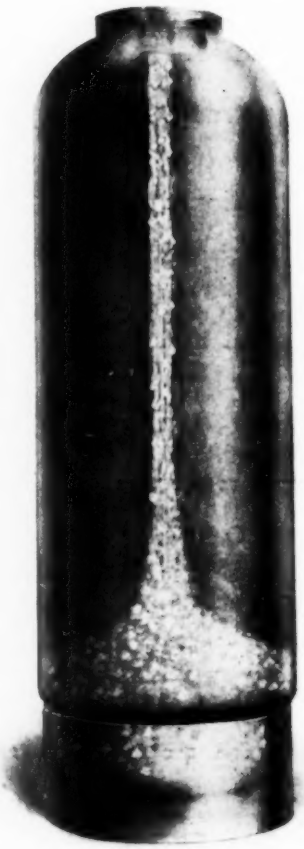

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